The

Journal of Heredity

(Formerly the American Breeders' Magazine)

Vol. VI, No. 11 November, 1915

CONTENTS

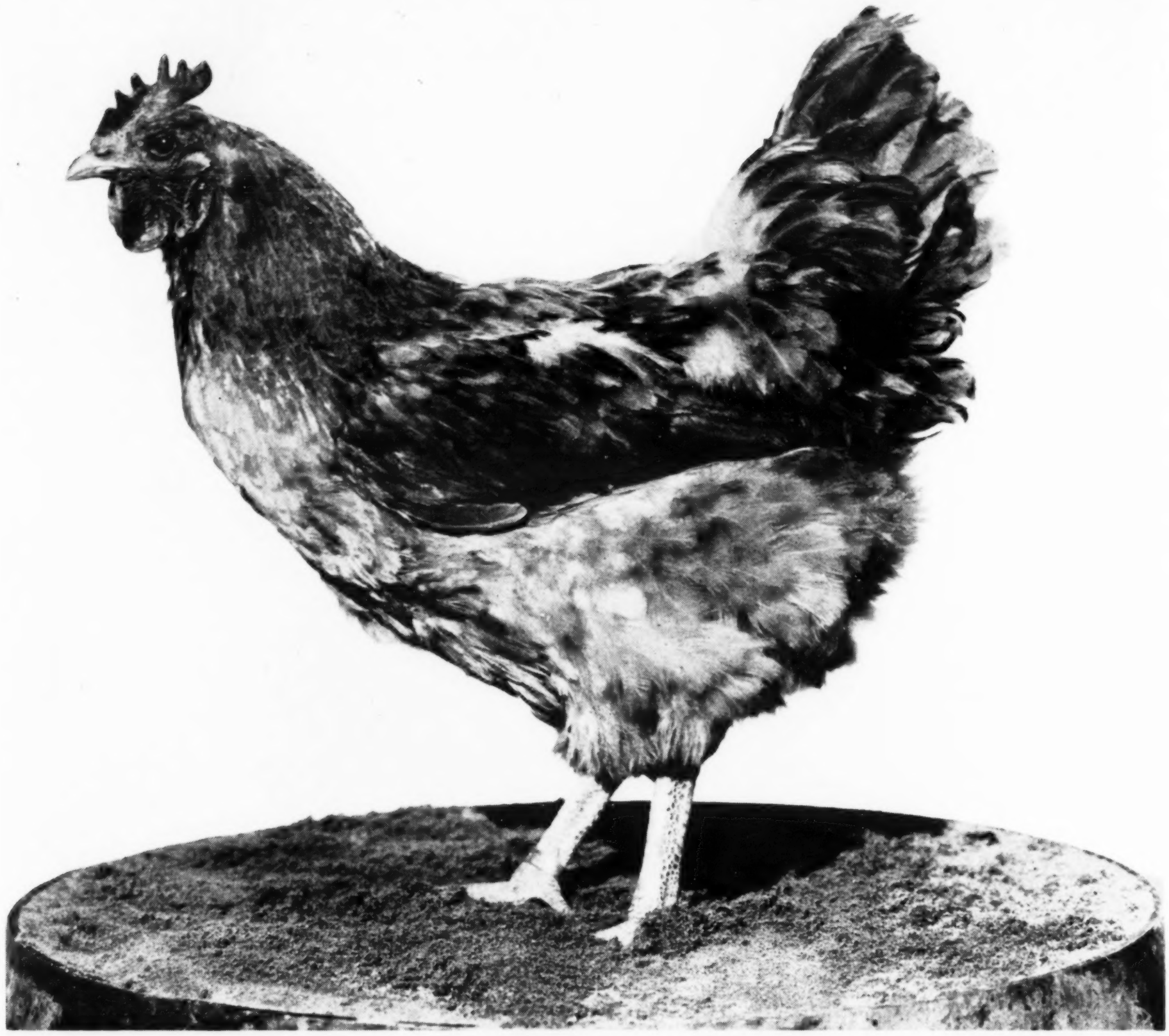
A Hen That Crowed (Frontispiece) 482
Poultry Breeding, by Rob R. Slocum 483
Redfield's Offer Still Open 487
Profitable and Unprofitable Hens 488, 489
How the Bark Breathes 490
New Publications: Microbes and Men, by Robert T. Morris; John and Elizabeth, by Jay Gee; Eugenics and Marriage, by Lee Alexander Stone 493
Effect of the Popular Sire, by Williams Haynes 494
Natural Selection in Man 497
Seeks to Find Best Nut-Bearing Trees 498
Garden Gladioli, by Alfred C. Hottes 499
New Publication Planned 504
Propagation of Wild Birds, Review of a Book by Herbert K. Job 505
Eugenics in the Colleges 511
Maternal Impressions, by the Editor 512
International Congress of Genealogy 518
Ancestry of the Goat 519
An Unusual Persimmon Tree 525
The Tree That Owns Itself, by T. H. McHatton 526
The Effects of Selection 527
Some Apple Statistics 528
Inheritance of Bad Temper 528

The Journal of Heredity is published monthly by the American Genetic Association (formerly called the American Breeders' Association) for the benefit of its members. Canadian members who desire to receive it should send 25 cents a year, in addition to their regular membership dues of $2, because of additional postage on the magazine; foreign members pay 50 cents extra for the same reason. Subscription price to non-members, $2.00 a year, foreign postage extra; price of single copies, 25 cents.

Entered as second-class matter February 24, 1915, at the postoffice at Washington, D. C., under the act of August 24, 1912. Contents copyrighted 1915 by the American Genetic Association. Reproduction of articles or parts of articles permitted provided proper credit is given to author and to the Journal of Heredity (Organ of the American Genetic Association), Washington, D. C.

Date of issue of this number, October 25, 1915.

A HEN THAT CROWED



This Buff Orpington hen, hatched at the Bureau of Animal Industry experimental farm, Beltsville, Md., began to lay on November 16 of that year and was trap-nested until November, 1914. In that period she laid 110 eggs, the last one on August 3, 1914, at which time she began to moult. Following the moult she began to develop the secondary sexual characters of the male; the tail feathers changed in appearance, the comb increased in size, the head came to look more like that of a cock, and the legs took on the redness characteristic of the male Buff Orpington. She was observed to crow several times; she occasionally visited the nest but never laid an egg. The above photograph from the U. S. Department of Agriculture was taken not long before she was killed, August 26, 1915, as the result of a general break-down of her health. Dissection showed no evidence of any development of male reproductive organs, but disclosed a large tumor on the ovary. It is a good hypothesis that this growth, by inhibiting the secretions connected with femaleness, had allowed the male characters to become apparent; for there is reason to believe that every fowl has the potential ability to develop the characters of either sex. (Frontispiece.)

POULTRY BREEDING

Experimental Work of Geneticists During Last Fifteen Years Has Shown Mode of Inheritance of Many Characters, but Has Not Materially Modified Practical Methods of Commercial Breeders[1]

ROB R. SLOCUM

Scientific Assistant in Poultry Investigations, U. S. Department of Agriculture, Washington, D. C.

IT IS not the intention in this paper to enter into a detailed discussion of the experimental work which has been carried on in breeding poultry in the last twenty-five years or to discuss the methods used, but simply to summarize briefly the results obtained and to comment on the possible or probable value of these results in practical poultry breeding. While the behavior of the characters of domestic poultry in inheritance, no matter what their nature, is undoubtedly a study of great scientific value and of general biological interest, it is nevertheless true that only so far as it has a bearing or a possible bearing on the practical problems of poultry breeding is it of interest to the great mass of poultry keepers and others vitally concerned with the vast poultry industry. It is this latter phase which is of paramount interest to the writer.

Domestic poultry as a subject for experimental breeding has much to commend it and has in consequence been one of the most popular classes of animals for this purpose. Not only are chickens widely diversified as to form and color, but in respect to many other characteristics, such as comb, number of toes, shank color, shank feathering, etc., the difference is great and the contrast sharp. Their comparatively small size with the resulting feasibility of keeping a large number at a relatively small cost is also a factor greatly in their favor. But perhaps the considerations which make chickens especially desirable for this class of work are the short time necessary to bring them to maturity, making it possible to secure a new generation each year, the relatively high fecundity, making it possible to secure a large number of offspring from a single mating, and the readiness of the fowls to breed at any season of the year.

BATESON'S PIONEER WORK

Following the rediscovery of Mendel's Law in 1900, there was begun and has since been carried on a considerable amount of experimental breeding of poultry. The first work along this line was that of William Bateson and others as detailed in the reports to the Evolution Committee of the Royal Society of London. Since then many others have taken up work of a similar nature. In this country, the Carnegie Institution's Department of Experimental Evolution at Cold Spring Harbor, Long Island, N. Y., under the direction of C. B. Davenport, has been especially active along these lines. Practically all of the breeding has been cross-breeding with the object of testing the behavior of characters of the individuals crossed to see whether they behaved in accordance with Mendel's Law. Theory and results have on the whole been in fairly close accord. As a result of these experiments a considerable mass of data has been secured, most of which has to do with the dominance or recessiveness of unit characters of poultry and with the limited inheritance of certain characters

[1] Address before the twelfth annual meeting of the American Genetic Association, at Berkeley, Calif., August 3, 1915.

or the repulsion between two factors resulting in what is known as sex-limited inheritance.

An explanation of what constitutes dominance or recessiveness is unnecessary and is not offered in this paper. It is only desired to show in tabular form the dominance and recessiveness of many of the common characters of poultry as they have been worked out. For this purpose it is impossible to do better than to use intact the table given by Dr. P. B. Hadley in the 1915 American Poultry Year Book.

TABLE SHOWING THE MODE OF INHERITANCE OF SOME OF THE COMMON CHARACTERS OF POULTRY

Dominant	*Recessive*	*Remarks*
Dominant white (Leghorn)	Black, red, buff	Almost complete dominance
Black, red, buff	Recessive white (Minorca)	Almost complete dominance
Black (Hamburg, Minorca)	Red, buff (Wyandotte)	Almost complete dominance
Barred plumage-pattern	Recessive white, black self-color	Sex-limited inheritance
Game pattern (Leghorn)	Recessive white (Minorca)	Sex-limited inheritance
Black self-color (Minorca)	Hackle-lacing (Brahma)	Imperfect dominance
Plain feathering	Silky feathering	Complete dominance
Frizzle feathering	Normal repent feathering	Complete dominance
Rose or pea comb	Single comb	Complete dominance
Single comb	Comblessness (Breda)	Complete dominance
Crest (Silky)	No crest	Imperfect dominance
Normal head	Cerebral hernia (Polish)	Imperfect dominance
Rumplessness	Normal uropygium	Imperfect dominance
Extra toes	Normal foot	Imperfect dominance
Joining of toes	Normal foot	Imperfect dominance
Silky pigmentation	Normal mesoderm color	Imperfect dominance*
Yellow skin color	White skin color	Complete dominance
Yellow shank color	Light shank color	Complete dominance
Dark shank color	Light shank color	Complete dominance
Black iris color	Brown, red, pearl iris	Complete dominance
Red ear-lobe	White ear-lobe	Imperfect dominance
Feathered shanks	Clean shanks	Imperfect dominance
Plain heel	Vulture hock (Silky)	Imperfect dominance
Booting (Silky)	No booting	Imperfect dominance
Beard (Houdan)	No beard	Almost complete dominance
Long tail (Japanese)	Normal tail	Imperfect dominance
Rapid feathering	Slow feathering	Almost complete dominance
Broodiness (Silky)	Non-broodiness	Almost complete dominance

* Sex-limited in Brown Leghorn and Silky crosses.

It will be noted from this table that in only a few cases is dominance listed as complete. There is a variation all the way from complete dominance to a very weak dominance and to explain this variation it has been necessary to fall back upon the idea of prepotency. It might also be well to call attention here to the case of the blue color of the Andalusian where neither of a pair of characters shows dominance over the other. The Black Andalusian and the Splashed White Andalusian bred together give all blue offspring. These blues when bred together give blacks, splashed whites and blues in the usual mendelian proportion. Here the black color and the splashed white seem to be the mendelian characters, neither of which proves to be dominant but the two exist side by side in the hybrid in a minute mosaic which causes the blue color. The blue individual is therefore always heterozygous or "mongrel."

In addition to the characters tabulated, recent studies with the "bare-neck" breed of poultry support the view that the nature of the factor which prevents feather growth on the neck is dominant.

SEX-LIMITED INHERITANCE

Certain of the characters of domestic poultry are inherited in a manner known as sex-limited. We are accustomed to observing the usual limitation of certain secondary sexual characters to their respective sexes, such as the spur and long sickle feathers of the cock, but it has remained for experimental breeding to point out that certain other characters are also sex-limited. Per-

haps the best known example of sex limited inheritance is the barred color pattern of the Barred Plymouth Rock, which seems to occur in accordance with a mendelian hypothesis developed along lines first suggested by Spillman.

The female, by this hypothesis, is considered to be heterozygous both for sex and for barring while a repulsion is assumed between the determiners for these two characters which prohibits their occurrence in the same gamete. The male is considered to be homozygous in respect to sex and either homozygous or heterozygous in respect to barring. The females, therefore, inherit barring from their sire alone. A number of different crosses have been made and reported which support this hypothesis, *e.g.*, Black Langshan and Barred Plymouth Rocks, Cornish Indian Game and Barred Rock, White Cochin and Tosa, and Barred Plymouth Rocks with Campines, with Golden Pencilled Wyandottes, with Black Hamburg, with White Wyandottes and with White Plymouth Rocks.

Sex-linkage has been reported in a number of other instances, such as an inhibiting factor influencing the mesodermal pigmentation of the Silky, Brown Leghorn color pattern, an inhibition for red in the plumage carried by the Columbian Wyandotte, the gray of the White Wyandotte and the factor on which high fecundity depends.

INHERITANCE OF EGG PRODUCTION

For about nine years, from 1898 to 1907, at the Maine Agricultural Experiment Station, a systematic breeding experiment was carried on in an effort to increase the average egg production of the Station's poultry stock. The plan of the experiment was to select breeders upon the basis of their performance alone as shown by the trap nest. It was expected that the high production would be handed down from mother to daughter and that the selection practiced would be cumulative in its effect. Indeed it was generally supposed that a substantial increase in the average egg yield had been obtained but a complete and searching analysis not only failed to reveal such an increase but actually showed a slight decrease since the beginning of the experiment.

In 1907 the plan of procedure was changed and one of the steps taken was to cross the original stock of the station, the Barred Plymouth Rock, a breed of relatively good laying ability, with the Cornish Fowl, a breed of relatively poor laying ability. A study of the inheritance of fecundity in these cross-bred individuals and in other matings resulted in the hypothesis advanced by Dr. Raymond Pearl, that the factor responsible for high egg production behaved as a sex-limited character. According to this hypothesis, the female is heterozygous for sex and also for the factor for high fecundity and these two factors cannot be present in the same gamete. It follows therefore that a daughter cannot inherit high fecundity directly from her dam but must always inherit it, if present, from her sire. She may, however, inherit low fecundity from either dam or sire or from both.[2]

PRACTICAL RESULTS

The application of Mendelism to poultry breeding holds out not the slightest hope of creating new characters. It does, however, point out the way to secure new combinations of desired characters by crossing varieties or breeds possessing them and by careful breeding to fix this combination in one breed or variety. In so far as a pair of characters behave as a strictly representative Mendelian pair, one of which shows complete dominance over the other, the application of Mendelism to poultry breeding will prove an advantage in poultry work as it will often provide a short cut to the desired end by providing a quicker means of testing out the purity

[2] The conclusions of the Maine station are based on the belief that high egg production is a unit character. But the results of eight years work at the Utah station, presented by E. D. Ball and Byron Alder at the last meeting of the American Genetic Association, but not yet published, fail to confirm this conclusion. The twenty-seventh annual report of the Massachusetts Agricultural Station, summing up the studies on egg-production there, also indicates a belief that high egg production is a compound, not a simple, trait. The question probably must be considered an open one for the present.

of a bird with respect to the particular character or characters. It will also often serve as a means to prevent the beginner in poultry breeding from making mistakes.

Unfortunately, however, the dominance of one of a pair of characters over another is in most cases not complete. As a consequence, results are not sufficiently exact and clean-cut to allow the application of the principles of Mendelism with assurance and reasonable certainty. Because the character or characters do not segregate in a pure state, it becomes necessary for the breeder to adopt a system largely empirical, with the object of using in his matings those individuals or lines which show the greatest purity in this respect. In other words, he must depend very largely as a basis of selection of breeders upon the results obtained in the offspring. He is unable to predict with sufficient certainty just what the results will be. Now this is exactly the position which the practical breeder has always occupied. He must select his breeders upon the basis of their appearance, upon his knowledge of their ancestry and principally upon the results obtained from breeding them. Therefore, while the Mendelist uses as his guide in breeding, the principles of Mendel's Law and the practical breeder uses the knowledge accumulated through experience, the methods used by each to secure a desired result in actual practice are identical or nearly identical. There is little in the data so far obtained as the result of experimental breeding which will enable the practical breeder to breed with a much greater degree of certainty or which would enable him to change his operations for simpler procedure.

BREEDING FOR EGGS

Dr. Pearl in connection with his hypothesis of the method of inheritance of high fecundity, advances for the benefit of the practical poultry breeder a plan for improving the average egg production of his flock. This consists of the following steps:

(*a*) Selection of all breeding birds on the basis of constitutional vigor and vitality;

(*b*) The use as breeders of such females only as have shown themselves, by trap nest records, to be high producers;

(*c*) The use as breeders of such males only as are known to be the sons of high producing dams;

(*d*) The use of a pedigree system by which it is possible to tell the sire of any particular bird;

(*e*) The making of a large number of matings so as to use as many different male birds as possible and;

(*f*) The continued but not narrow inbreeding of those lines in which there is a preponderance of daughters which are high producers.

In connection with this plan it only remains to point out again that such a plan is identical or very nearly so with the steps which any intelligent breeder of experience would take if he attempted to make any systematic effort to better the egg production of his stock. The only point where it might differ would be in the matter of testing out the various males and breeding those lines showing the greatest promise. However, any poultryman who is sufficiently interested in his breeding to make an attempt to keep a pedigree record of his birds, or at least a pen record—and many of them do—would certainly fail in intelligent effort if he did not concentrate his breeding on those lines which showed most favorable results.

The experimental breeding of poultry has undoubtedly been of benefit to the poultry industry generally. Not only has it given us a considerable amount of information as to the manner in which characters are inherited but by arousing interest in the subject, it has caused poultrymen to give more careful thought to the problems by which they are confronted. It has also called attention to the necessity of keeping more exact pedigree records and by so doing will undoubtedly bring about much more systematic efforts which will in turn lead to greater progress.

The work which has already been reported and the interest aroused has brought about the inauguration of

work of a similar nature at many of the State Experiment Stations in the United States. The various stations have been asked to supply a brief statement of any work in poultry breeding which they may be carrying on and the replies of those stations which sent in a report and are carrying on any work of this nature are briefly summarized below:

Purdue University Experiment Station, Lafayette, Indiana.

A study of the influence of inheritance on egg production.

Kansas Experiment Station, Manhattan, Kansas.

A study of the value of standard bred males from high producing lines in grading mongrel flocks.

Maine Experiment Station, Orono, Maine.

1. Inheritance of fecundity and breeding for egg production.
2. Mendelian inheritance of various plumage and other bodily characters.
3. Inheritance of body size, egg size and color.
4. Inbreeding.
5. The effect of various external agents on the germ plasm.
6. The inheritance and determination of sex.

Massachusetts Experiment Station, Amherst, Massachusetts.

1. Breeding for egg production.
2. A study of the hatching quality of eggs from the genetic standpoint.
3. Inheritance of various external characters of poultry.

Missouri Agricultural Experiment Station, Columbia, Missouri.

A study of sex-limited inheritance of the spangled pattern of the Hamburg and the "hen-feathering" of the Sebright Bantam cocks.

New Jersey Experiment Station, New Brunswick, New Jersey.

1. Inheritance of fecundity.
2. Inheritance of various plumage characteristics and other body characters.
3. The barred factor in Single Comb White Leghorns.
4. Inheritance of shell color.

North Carolina Experiment Station, West Raleigh, North Carolina.

1. Inheritance of high egg production.
2. Inheritance of shell color of eggs.

Oregon Experiment Station, Corvallis, Oregon.

1. Inheritance of high egg laying.
2. Correlation between type and high egg laying.
3. Cross breeding.
4. The development of a special variety of chickens with high egg production and also good meat quality.

Utah Experiment Station, Logan, Utah.

1. A study of the possibility of improving egg production by continued selection.
2. A study of egg production with special reference to (*a*) average winter egg production as compared with the average yearly production covering a period of the first, second and third years of production, and (*b*) limits of seasonal variation in the average flock production.

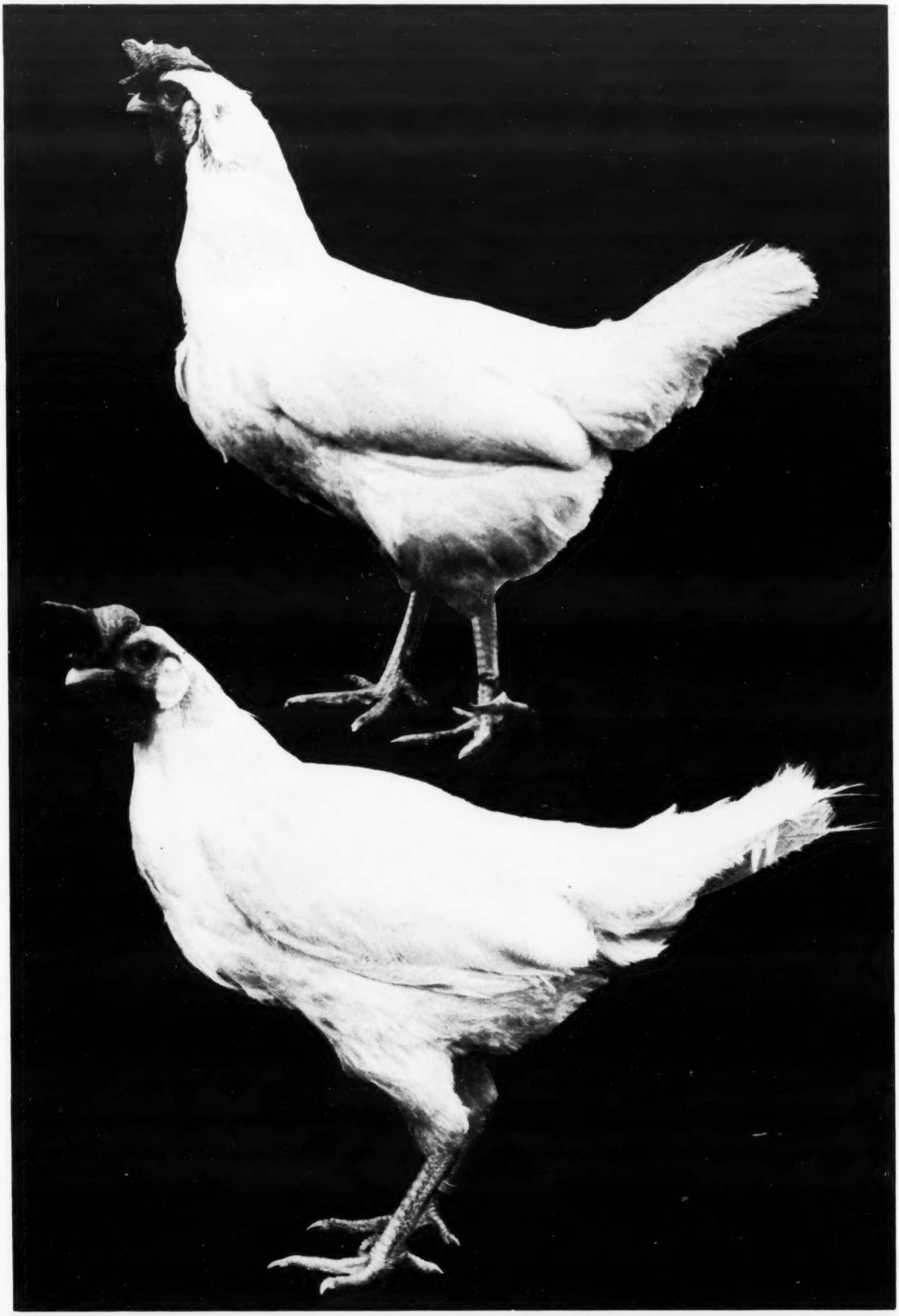
Wisconsin Experiment Station, Madison, Wisconsin.

1. Experiments on inbreeding.
2. Study of the effects of lead poison of the male upon his offspring.
3. Inheritance of plumage color and some other characters in pigeons.

Redfield's Offer Still Open

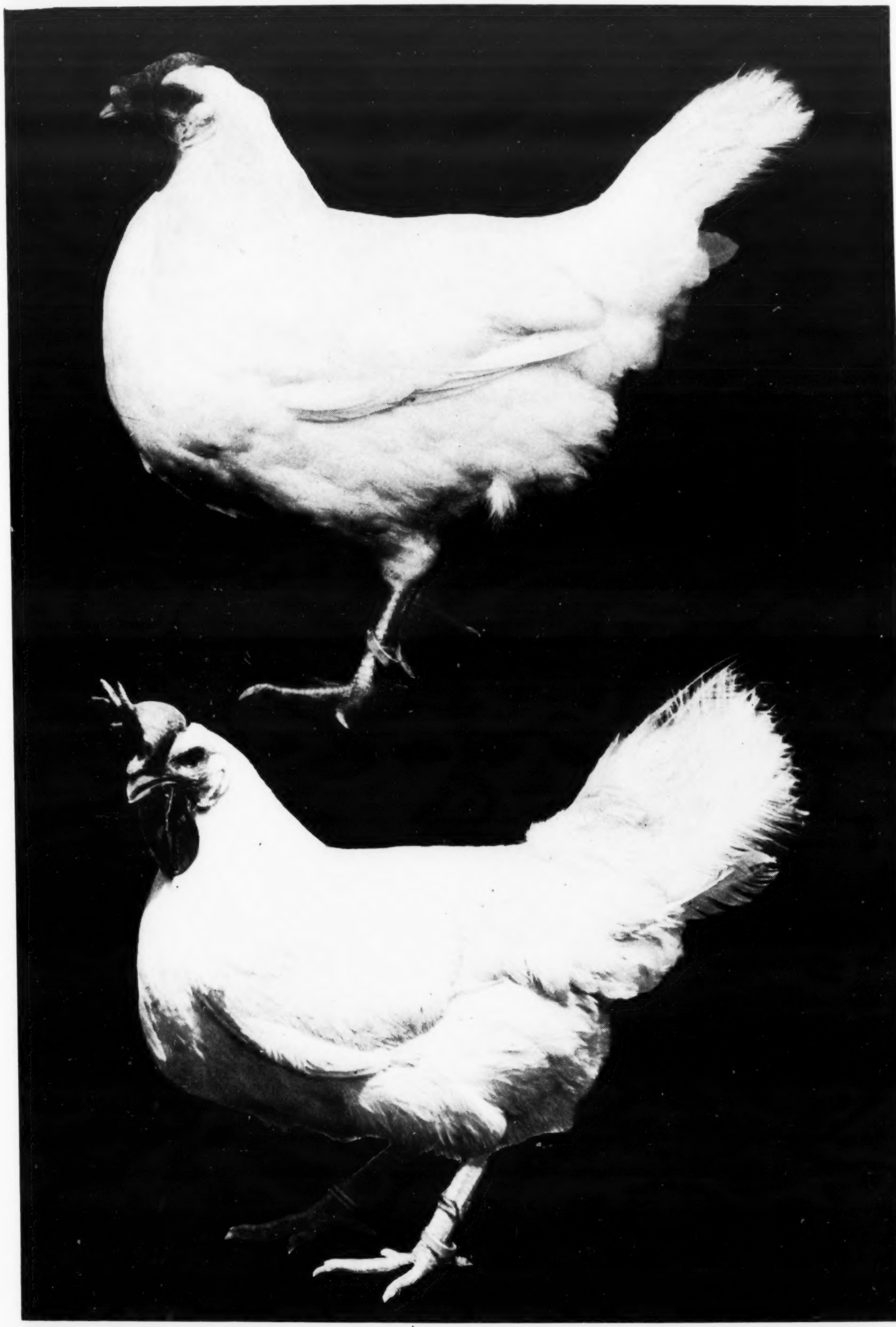
Attention is called to the fact that C. L. Redfield's offer of a reward for data regarding early marriages closes at the end of the present year, and up to date has not been productive of results. He proposes to donate $100 to this association "if it can be shown that any superior individual ever was produced by breeding human beings as rapidly as four generation in a century," or "if there can be found more than three cases in which the intellectually superior person has as many as four generations in a century in the tail-male alone." By "superior individuals" he understands "any one of the 2,000 or 3,000 intellectually eminent men known to history." Again, raising the standard to the two or three hundred great geniuses of history, he proposes to donate another $100 if a single one of them can be found in the three-generations-to-a-century class. The association will be glad to hear from genealogists who can throw light on these matters.

THESE HENS ARE PROFITABLE



In a test of White Leghorns at Hawkesbury Agricultural College, Richmond, New South Wales, 1913-1914, the hen above laid 219 eggs in twelve months, the hen below laid 288 eggs in the same length of time. The latter figure represents a record which has been equaled but never surpassed. Hens of the type here shown should be chosen by the poultryman who wants a flock that will earn its keep. Photographs from the Agricultural Gazette of N. S. W. (Fig. 1.)

THESE HENS SHOULD GO TO THE POT



In the Hawkesbury Agricultural College competition the hen shown above laid only ten eggs between April 1, 1913, and March 31, 1914. The hen below laid only twenty-three eggs in the same period. Hens of this type should not be kept in a pen intended for egg production. It is likely that their fatness shows they have kept all their nutrition for themselves, while the lean hens on the opposite page have devoted much of their nutrition to producing eggs. Photos from Agricultural Gazette. (Fig. 2.)

HOW THE BARK BREATHES

LIKE all other living things, plants must breathe or they will not continue to live. The more highly specialized among them are therefore provided with elaborate respiratory systems, consisting of passages which conduct air to all parts of the plant, and openings on the surface, through which oxygen can be taken in and carbon dioxide given out, substantially as is the case with animals.

The external openings of this ventilating system are of three general types: stomata or valves on the surfaces of leaves and young shoots;[1] ventilating pores, which occur in certain aerial roots; and lenticels, pores in the older wood, whose presence can be noted by the unaided eye in almost any plant, and which are photographed, enlarged, in Figs. 3 and 4.

The earlier naturalists were quite in the dark as to the function of these pores. Guettard, who described them in 1745, designated them merely as glands; De Candolle (1826) thought they were a kind of bud, from which roots later put forth; Unger (1838) believed they had something to do with reproduction; but as early as 1809, Dupetit-Thouars declared their purpose was ventilation, and the work of several students during the next half century demonstrated that this opinion was well founded.

Although he misunderstood their purpose, De Candolle gave them the name which they now bear, because of the resemblance of one of these pores to a minute, bi-convex lens, in general shape.

They are usually found on both stem and root of a plant, but may also appear on leaf-stems, and sometimes on fruits—the walnut and horse-chestnut, for instance.

Yet, in spite of their widespread distribution, they have been sought in vain on some plants. They appear not to exist on the European grape (*Vitis vinifera*), although they can easily be seen on its close relative, the Scuppernong grape of the southern United States (*Vitis rotundifolia*); they have been not discovered on the Italian honeysuckle, the trumpet creeper *Tecoma radicans*, some species of Clematis, the Philadelphus or mock-orange, Deutzia, *Rubus odoratus*, etc.

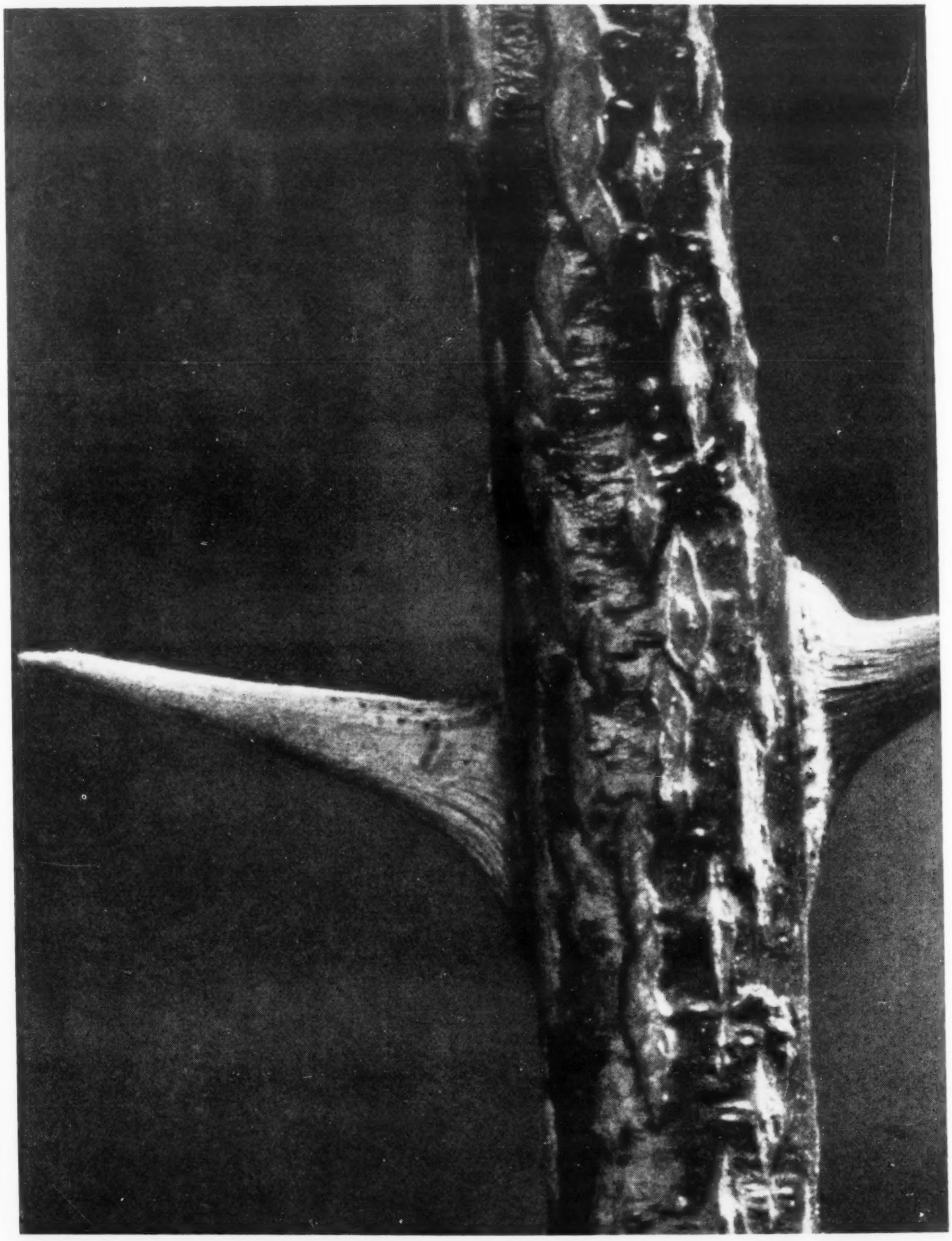
It has been explained that these plants are provided with a regularly repeated annular formation of the bark, and therefore do not stand in such need of lenticels for the purpose of ventilation. But this hypothesis carries little weight, when one finds that other plants with similar bark have lenticels. Why, for instance, should the climbing honeysuckles lack these organs, while those which do not climb possess them? And why are they present in the bittersweet (*Solanum dulcamara*), the Boston Ivy (Ampelopsis), the Wistaria, and other plants which have habits of growth and formation of bark similar to those above referred to, which lack lenticels?

Another difficulty in the way of believing the idea once held, that they are indispensable to the respiration of the plant, is the fact that during a considerable part of the year they are partly or wholly closed by the formation of a layer of cork underneath them. This is particularly the case in winter, the plant's resting period, when little ventilation is necessary; but observers have found that this closing of the ventilators often begins in early summer, so that spring is the only season when the lenticels are functioning.

Further, it has been discovered that the lenticels are in some cases permanently closed: they look normal from the outside, but are in reality of no value whatever to the plant for breathing.

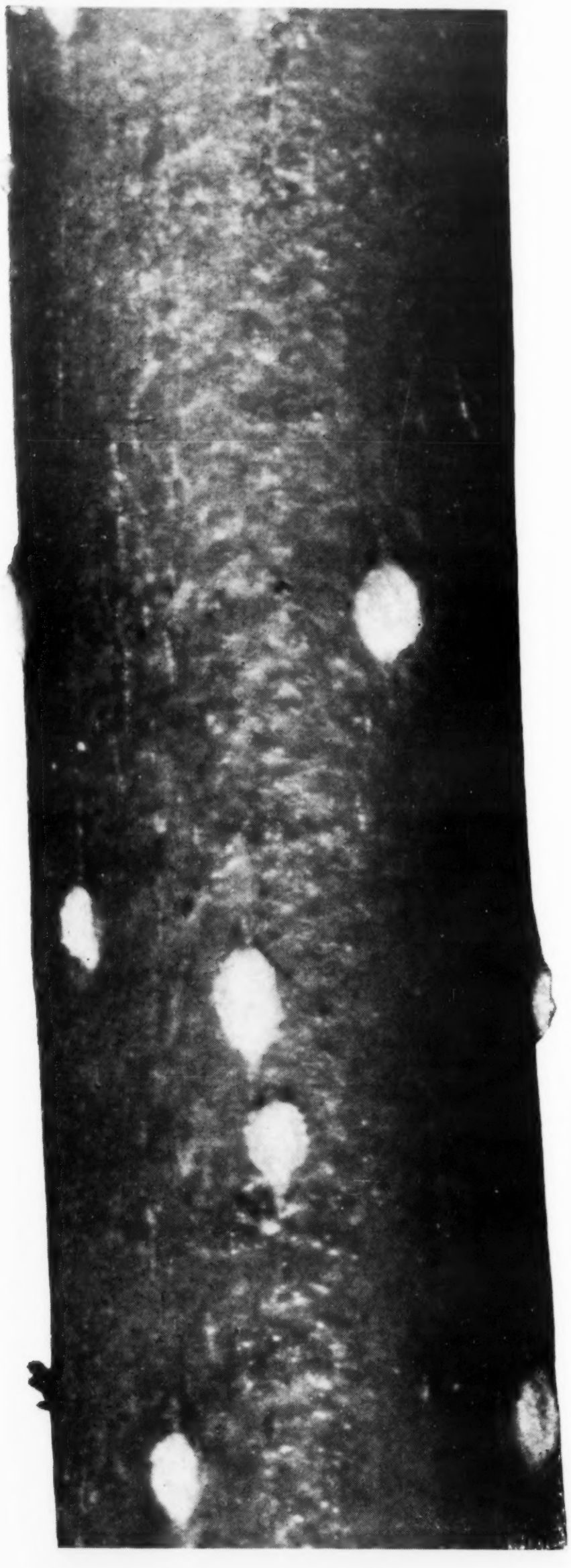
---

[1] For an excellent photograph of stomata on a wheat leaf, enlarged about 300 diameters, see the JOURNAL OF HEREDITY, Vol. VI, No. 3, p. 125, March, 1915.



THE VENTILATORS OF A ROSE TWIG

The irregular openings or "eruptive craters" in the bark, photographed under high magnification, are known as lenticels, and serve as pores through which air is admitted to the inside of the plant. By channels and passages of various kinds between the interior cells of the plant, the air passes to even the most distant parts. The plant is thus enabled to renew its supply of oxygen, and at the same time it discharges carbon dioxide through the lenticels. (Fig. 3.)



ON A MOIST DAY

Twig of a Chinese magnolia, highly magnified. The dry, powdery cells which fill the breathing pores of the bark have absorbed moisture from the air, until they have swelled out and protrude like warts. One of the functions of the lenticels is to regulate the transpiration of moisture between the interior of the tree and the outside air. (Fig. 4.)

These facts have led many plant physiologists to think that, although the lenticels undoubtedly do fulfil in many cases the function of breathing pores for the bark, that is not really their *purpose*. Such a solution of the problem accords well with the interpretation of nature of certain scientists, who hold on philosophical grounds that nothing should be said really to have a purpose.

EXPERIMENTAL TESTS

But whether breathing is the *purpose* of the lenticel or not, one can very easily demonstrate that it actually does act in most cases as an outlet for the plant's ventilating system. A favorite laboratory experiment is to seal up one end of a stick, seal a tube around the other end, and then force air under pressure through the stick, submerged in water. A string of fine bubbles will issue from every lenticel. The fact can be demonstrated even more easily, merely by sealing both ends of a short stick and then submerging it in warm water; the warmth will in most cases be sufficient to expel the cooler air within the stick, and bubbles will appear at the lenticels.

Sometimes these openings reach a length as great as a third of an inch; in other cases, as in the bark of the sycamore (Platanus), they are so small as to be almost microscopic. In twigs they are commonest on the under side, and the number increases somewhat regularly with the age of the wood. On a piece of elm branch 20 centimeters long, Haberlandt found the number of lenticels as follows:

	First year	Third to fifth years	Tenth to fifteenth years
Upper side	55	66	95
Under side	70	78	96

The lenticels usually begin formation under the surface, frequently beneath one of the stomata, in which case, as the epidermis is gradually replaced by cork (*i. e.*, bark), the lenticels take the place of the stomata as ventilating pores.

Structurally, the lenticel may be described in simplest terms as an opening through the bark, which is filled,

in most cases, with a mass of powdery packing-cells, so loosely arranged that air can easily pass between them. In wet weather these cells usually expand and protrude from the opening, so that the lenticel comes to resemble a wart.

This response to the humidity of the outside air gives the clue to another function which the lenticels share with the stomata—to aid in regulating the transpiration of the plant. Indeed, Devaux,[2] one of the latest botanists to give the subject careful study, concludes that it is more correct to say they regulate the amount of moisture in the plant than to ascribe ventilation as their chief function.

[2] Recherches sur les Lenticelles, by H. Devaux, professor at the University of Bordeaux. Annales des Sciences Naturelles, 8ième série, Botanique; t. XII, 1900.

NEW PUBLICATIONS

MICROBES AND MEN, by Robert T. Morris, M. D. Pp. 539, price $2 net. New York, Doubleday Page & Co., 1915.

It is rather difficult to think of any social question on which this book by a distinguished New York surgeon does not touch. His aim is to show the influence of the microbe in all evolution; to demonstrate that "the microbe limits cultivation of any organism because under conditions of higher cultivation organisms become more and more susceptible to microbe influence. The logical end of culture is elimination of the race among plants and animals." But the book itself is far more readable than one would suspect from this synopsis: one can dip into it anywhere and find something to stimulate thought. Dr. Morris intimates that one of his hopes is to cause readers to disagree with him, and he will doubtless attain this end in many cases. But at least, the reader will be interested. The layman, however, should bear in mind that the author does not always make it clear whether his statements are based on fact or speculation.

JOHN AND ELIZABETH, a Romance in Real Life, by Jay Gee. Pp. 162, price 50 cents. Washington, D. C., the Volta Bureau, 1601 Thirty-fifth Street NW.

Mr. Gee frankly declares that he has written a novel with a purpose—"to show the great dangers of hereditary disease." Congenital deafness furnishes the background of a simple love story, or rather, the love story serves as a vehicle to carry a rather full discussion of congenital deafness. Novels with purposes are not new, but Mr. Gee has performed a really extraordinary feat in writing one, the scientific basis of which is perfectly sound. The book can be recommended without hesitation to anyone who wants a sugar-coated statement of modern views as to the inheritance of congenital defects.

EUGENICS AND MARRIAGE, by Lee Alexander Stone, M.D. A Primer of Social Hygiene. Reprinted from the *Journal of the Tennessee State Medical Association*, September, 1915. Pp. 64; price 25 cents; by the author, Memphis, Tenn.

EFFECT OF THE POPULAR SIRE

A Statistical Study of Three Varieties of Terriers—Over Forty Per Cent. of the Puppies Sired by Approximately Twenty Per Cent. of the Stud Dogs—Popularity and Prepotency—A Cause of Variation

WILLIAMS HAYNES
Author of "Practical Dog Breeding," etc.

WHEN the cattle breeder says "the bull is half the herd" he expresses one of the fundamental differences between natural selection and the artificial selection practiced by animal breeders. Even with sheep, cattle, horses and other gregarious animals, among which, in a wild state, the stronger and more vigorous males certainly beget more offspring than their weaker rivals, artificial selection undoubtedly gives increased opportunities to the selected sires. No wild male, however superior physically to his rivals, ever sired so large a proportion of the succeeding generation as does the popular sire chosen by breeders. In the case of animals which, in a natural state, mate in pairs or in small groups, obviously this effect is very much more marked.

In order to arrive at a definite expression of this important factor in artificial selection, I have made a statistical study of three breeds of terriers, dogs offering a peculiarly good field for a study of this kind. That the results might be as typical as possible, I have selected three breeds of the same general family: all well established as to type and all generally popular all over the country. Registrations of different individuals of the same litter have been discarded, so that each unit represents an entire litter. Obviously all thoroughbred litters are not represented in the Stud Book, but I have chosen breeds in which a great number of the breeders register, and, as the average terrier litter numbers about 5.25 puppies, a considerable number of the entire population for the year must be included in these figures. The results, which are from the American Kennel Club Stud Book, Vol. XXIX (1912), can, I believe, be taken as thoroughly representative. (See table at bottom of page.)

In other words, 15.5% of the Irish terrier sires whose get was registered during 1912 sired 33.96% of the puppies; 22.77% of the Scottish terriers got 45.00% of the pups; and 24% of the fox terriers got 46.73%. For the three breeds, 19.49% of the sires got 43.20% of the puppies, or to express the totals in figures (assuming 5.25 pups to the litter) we have 818 individuals out of 1,874 sired by but 54 out of the 277 stud dogs.

Since to sire two litters can hardly be considered a mark of any particular popularity, we probably get a truer expression of the factor of popularity as such, by omitting the two litter dogs. This gives 7.94% of the stud dogs (twenty-one individuals) sireing 22.91% of the puppies (451 individuals).

The practice of dog breeders is liberal in the choice of a stud dog to which to mate their bitches. The majority do not keep a stud dog, and even those who do so, though subjected to the usual temptation to breed to their own dog (convenience, expense, and increasing his reputation as a sire), are able to enjoy wide latitude in choice. Stud fees are quite uniform and comparatively low, ranging from $15 to $25. Transportation charges on so small an

	1 Litter Each		2 Litters Each		3 Litters Each		4 Litters Each		5 Litters Each		7 Litters Each		Breed Total	
	Sires	Litters	Sires	Litters	Sires	Litters	Sires	Litters	Sires	Litters	Sires	Litters	Sires	Litters
Irish terriers	70	70	9	18	1	3	2	8	..	..	1	7	83	106
Scottish terriers	78	78	13	26	5	15	2	8	2	10	1	7	101	144
Fox terriers	75	75	11	22	3	9	3	12	..	..	1	7	93	125
Total	223	223	33	66	9	27	7	28	2	10	3	21	277	375

MOST POPULAR LIVING SCOTTISH TERRIER SIRE

Champion Bapton Norman is considered by Mr. Haynes to be "one of the most phenomenal sires of any breed of dogs that has ever appeared;" when only three years old he had already sired three champions and nine winners of championship points or certificates. He is owned by J. Deane Willis of Bapton Manor, Codford St. Mary, Wilts., England, and many American owners have imported bitches bred to this famous dog, in order to get as much of his blood as possible in this country. (Fig. 5.)

animal are light (a terrier bitch can be sent from New York to Chicago and back for $15) and there is little inconvenience and slight risk in sending her on a considerable journey to be bred. For these reasons, dog breeders are but little restricted in selecting whatever sire their judgment dictates as the best mate for their bitches. Popularity has very free play.

But popularity at stud is, so all breeders have been often warned, a very poor indicator of breeding ability. It is therefore interesting to see whether these dog breeders, who are so notorious for following fads and fancies, have selected really important sires, or are merely attracted by show points. In each breed one dog, as the sire of seven litters, stands out markedly as the most popular stud dog of the year.

The Irish terrier is Champion Thorncroft Sportsman. That capital authority—especially strong in this his favorite breed—the late James Watson says of him in a posthumous article on dog breeding published recently,[1] "the French bulldog Nellcote Gamin and the Irish terrier Thorncroft Sportsman, ... have no such heritage of special selection[2] but control simply by individual dominance . . . and it behooves the Irish terrier fanciers and the French bulldog breeders to conserve

[1] Field and Fancy, Vol. XXXVII, No. 3, p. 12.

[2] That is, they are not dogs inbred to a special strain.—W. H.

the prepotency demonstrated in the dogs . . . to which attention has been drawn." Three years ago Irish terrier breeders had already discovered this prepotency, and as early as 1912 this dog was the most popular sire.

AN ENGLISH WINNER

The case of the most popular Scottish terrier is even more remarkable. The dog Champion Bapton Norman was at the time only three years old, but he had already sired three champions and nine winners of championship points or certificates. Since then he has proved himself to be one of the most phenomenal sires of any breed of dogs that has ever appeared, but his English breeder has refused all offers for the dog and he is still in England. That a dog in England should be represented in the American stud book by more litters than any dog in this country is unexpected. That he should be so young a dog and that he should since then demonstrate that he is one of the great sires of all time shows that a prepotent individual is sometimes discovered early and that a number of dog breeders, certainly Scottish terrier breeders, are importing for blood as well as points.

The case of the fox terrier, Sabine Reserve, is not so clear cut. As a stud dog he is hardly so prepotent an individual as either Thorncroft Sportsman or Bapton Norman, yet he is bred from that eminent producing strain founded by Champion Sabine Result, and of his get registered during 1912 one became a champion and four others were winners at the shows. Clearly, if not a phenomenal sire, he is much above the average in his heredity and in his capabilities.

When in three breeds, picked as representative, the most popular sires prove to be also important sires—two of them truly great sires—it makes one wonder if the consensus of breeders' opinions does not come closer to the mark in selecting as the popular the truly prepotent individuals, than we are prone to believe. Prepotency runs in certain families in dogs as in other animals[3] and this, being recognized by dog breeders, undoubtedly influences selection, but only indirectly. The reputation of the individual dog, both as a show winner and a sire of winners, is almost always the determining factor in a breeder's selection, but it can hardly be a coincidence that in these three breeds popularity and prepotency should have been combined.

Superficially it might appear that if approximately 40% of the puppies each year are sired by but 20% of the stud dogs this would eventually result in the greatest uniformity of type. The selected sires are all to a greater or lesser degree exceptional individuals, but they are not selected by any uniform system. Most of them excel in some particular physical point, but they do not excel in the same points or in the same degree, nor even, in some cases, in the same direction. Here the personal equation, the ideals of different breeders, is at work, and the result is that since a few males not themselves of uniform type sire a greater-than-average number of offspring they disturb the race average of the following generation and introduce abnormal amounts of variation. The fact therefore, that artificial selection gives to certain selected, but not uniform, males an undue preponderance of influence must always keep the type of domestic animals in an unstable state. This seems to me an important factor in the great variability always noted among domesticated breeds.

[3] Becker, The Great Dane (1905), p. 41; Packwood, Show Collies (1906), pp. 18, 103; Davies, The Scottish Terrier (London n.d.), Chap. IV; Graham, The Sporting Dog (1904), Chaps. II, III, IV; Haynes, Practical Dog Breeding (1915), Chap. VI.

NATURAL SELECTION IN MAN

FEW people show any hesitancy in accepting the idea that Natural Selection is constantly at work among plants and the lower animals, weeding out the weak and unfit, and allowing only those to survive who are by heredity adapted to survive in their own particular environment.

But when the same doctrine is applied to man, a great many persons have hesitated. It was something of a shock to them to admit that the death of a friend or relative might be due to unfitness to survive.

The biologist could accept the application of natural selection to man without hesitation, but many others felt that they required proof, before they could open their minds so far.

It has therefore been a chosen task of Professor Karl Pearson, of the University of London, and his school of biometricians, to bring together mathematical proof of the operation of natural selection in man.

Pearson's first contribution to the subject, some twenty years ago, was in the form of a study of the inheritance of longevity. He found, to put the case very briefly, that there was a close connection between length of life in parent and length of life in child; and from this fact, demonstrated in various strata of the population, he was able to draw the conclusion that about two-thirds of all the deaths that occur nowadays, are due to natural selection: they are the deaths of those who, through heredity, were not able to survive in their environment.

The rest of the deaths must be set down to random causes. If a man is struck by a moving train, for instance, it is evident that his hereditary make-up will have little to do with his chances of survival.

It should be noted that we can not blame environment too much for deaths which we credit to natural selection. It is not wholly that the environment was bad. Dr. Alfred Ploetz, of Munich, investigated the royal families of Europe, where the environment may be fairly supposed to be as good as possible for every child, and found that even there 60% of all the deaths were due to heredity.

It should further be noted that when we ascribe a death to heredity, we do not necessarily mean a congenital defect in the ordinary sense of the term. A congenital lack of resistance to some specific disease is equally a matter of heredity, and is often a cause of death.

INFANT MORTALITY

In 1911 Dr. E. C. Snow published the results of an investigation on the infant mortality of parts of England and Prussia, in which he showed that a high death rate during infancy was followed by a low death rate during childhood, in the same group; and vice versa. Here was another evidence of the work of natural selection: Nature was weeding out the weakest, and in proportion to the stringency with which she weeded them out at the start, there were fewer weaklings left to die in the succeeding years.

Evidence from another source was published by Pearson in 1912. He dealt with material analogous to that of Snow, and showed "that when allowance was made for change of environment in the course of fifty years, a very high association existed between the deaths in the first year of life and the deaths in childhood (1 to 5 years). This association was such that if the infantile death rate *increased* by 10% the child death rate *decreased* by 5.3% in males, while in females the *fall* in the child deathrate was almost 1% for every *rise* of 1% in the infantile death rate."

To put the matter in the form of a truism, part of the children born in any district in a given year are doomed by heredity to premature death; and if

they die in one year they will not be alive to die in some succeeding year.

These researches involved some very difficult mathematical problems, to which nothing more than an allusion can be made here. They were based on a statistical method known as partial correlations. The object of the present note is to call attention to a new study[1] of the subject of natural selection, based on a new statistical method, which Pearson says is the most important contribution to the apparatus of statistical research that has been made for a number of years past. It is termed the Variate Difference Correlation method.

Its exact nature is of interest only to mathematicians, but every geneticist will be interested in the fact that it gives, according to Pearson, a more accurate result in the study of natural selection than any method heretofore known.

RESULTS OF NEW STUDY

Applying it to the registered births in England and Wales between 1850 and 1912, and the births during the first five years of life in the same period, Miss Elderton and Professor Pearson have found that the previous observations of a selective death rate are confirmed with increased accuracy. "For both sexes a heavy death rate in one year of life means a markedly lower death rate in the same group in the following year of life." This lessened death rate extends in a lessened degree to the year following that, but is not by the present method easy to trace further.

"It is difficult," as they conclude, "to believe that this important fact can be due to any other source than the influence of natural selection, *i.e.*, a heavy mortality leaves behind it a stronger population."

To avoid misunderstandings, it may be well to close this review with the closing words of the Elderton-Pearson paper. "Nature is not concerned with the moral or the immoral, which are standards of human conduct, and the duty of the naturalist is to point out what goes on in Nature. There can now be scarcely a doubt that even in highly organized human communities the death rate is selective, and physical fitness is the criterion for survival. To assert the existence of this selection and measure its intensity must be distinguished from an advocacy of high infant mortality as a factor of racial efficiency. This reminder is the more needful as there are not wanting those who assert that demonstrating the existence of natural selection in man is identical with decrying all efforts to reduce the infantile death rate."

[1] Further Evidence of Natural Selection in Man. By Ethel M. Elderton and Karl Pearson. Biometrika, Vol. X, Part IV, pp. 488–506. London, May, 1915.

Seeks to Find Best Nut-Bearing Trees

Endeavoring to enlist members of the American Genetic Association in a search for the undeveloped nut-producing resources of the United States, Professor J. Russell Smith, of the University of Pennsylvania, writes: "We now know how to graft them, so that the finding of them amounts to something. We have most surprising resources in the shape of rare nut trees, if we just knew where they were. As an example of these unknown resources, I will cite the recent discovery *in Indiana* of three or four of the finest pecan trees in the world. It took looking to find these trees from among the thousands of wild ones, but it is true that somebody, some boy, some hunter, some observant farmer, has his eye on nearly all of the extra fine nut trees in his neighborhood. He should tell the world about them, that's all. The way is easy—simply send samples of the nuts, with an account of the tree, to the secretary of the Northern Nut Growers' Association, Dr. W. C. Deming, Georgetown, Conn. This Association wants your help so badly that it is offering money for it—$50 for a hazel tree of American origin that can compete with the imported filberts; $10 for a Northern pecan better than we now have, and $20 for other nuts that are found by judges to be sufficiently valuable."

GARDEN GLADIOLI

Most Common Varieties Are Complex Hybrids Representing a Number of Distinct Species—Success Suggests That More Species Should Be Used in the Production of New Horticultural Forms of Other Flowers[1]

ALFRED C. HOTTES
Department of Floriculture, Cornell University, Ithaca, N. Y.

GLADIOLUS offers an excellent example of a genus of plants which has been improved for garden purposes by the incorporation of a number of species into more complex multiple hybrids than most of the flowers of the garden. The China aster (*Callistephus chinensis*), sweet pea (*Lathyrus odoratus*) peony (*Paeonia albiflora*) and Boston fern (*Nephrolepis exaltata* var. *bostoniensis*) have been improved solely by the selection of variations and mutations within a single species. Phlox, German iris, larkspur (*Delphinium*), dahlia, columbine (*Aquilegia*), begonia and chrysanthemum varieties have arisen from the hybridization of several species. The rose, orchid, pelargonium and gladiolus, however, often have in the make-up of their best varieties three to seven species, each contributing characteristics to the modern degree of perfection.

The genus Gladiolus consists of approximately 130 species, most of which are natives of South Africa, though several are of European origin. Previous to 1840, only a few forms commanded any attention horticulturally. One was the hybrid species *G. colvillei*, a rather dwarf plant with flowers characterized by a white area or lozenge in the throat, bordered by a deep color; a feature inherited directly from its parent, *G. cardinalis*. *G. tristis* var. *concolor* was used as the other parent of *G. colvillei*.

Another form was known as *G. ramosus*, a branchy plant which resulted from crossing *G. oppositiflorus* with various hybrids (now unknown) of *G. cardinalis*. *G. oppositiflorus* is a native of Madagascar and Natal, and bears a stem 3 to 6 feet tall which produces large white flowers with characteristic amethyst stripes in the throat. Twenty-four or even forty blooms are borne upon the stem, twelve of which are often open at one time. This tall, white, many-flowered species was crossed with *G. cardinalis*, a bright scarlet and rather dwarf species. The result of this crossing was *G. ramosus*, at that time thought to be quite admirable.

In 1837 Beddinghaus, gardener to the Duke of Aremberg, had growing on the estate in Engheim the *G. ramosus* hybrids, and besides these the Parrot Gladiolus, *G. psittacinus*. In this the upper segment is scarlet, with deep yellow medial line, and is also spotted with yellow at the base; the lower is rich yellow and scarlet. The plant grows to a height of three feet and is clothed for the most part by the sheathing bases of the leaves.

MYSTERY OF GHENT VARIETY

The species *G. ramosus*, *G. oppositiflorus*, *G. cardinalis* and *G. psittacinus* were crossed rather promiscuously. In 1841 a form appeared which was thought to be superb. In "Flore des Serres" was published an account of this new type, and it was said to be a hybrid between *G. cardinalis* and *G. psittacinus*. However, Dean Herbert and others, after attempts to cross these latter species, failed and declared that the new hybrid was *G. psittacinus* and *G. oppositiflorus* instead. A controversy over the parentage has raged since then, but to the writer the explanation is simple in saying that the new hybrid

[1] Address before the twelfth annual meeting of the American Genetic Association, at Berkeley, Calif., on August 5, 1915.

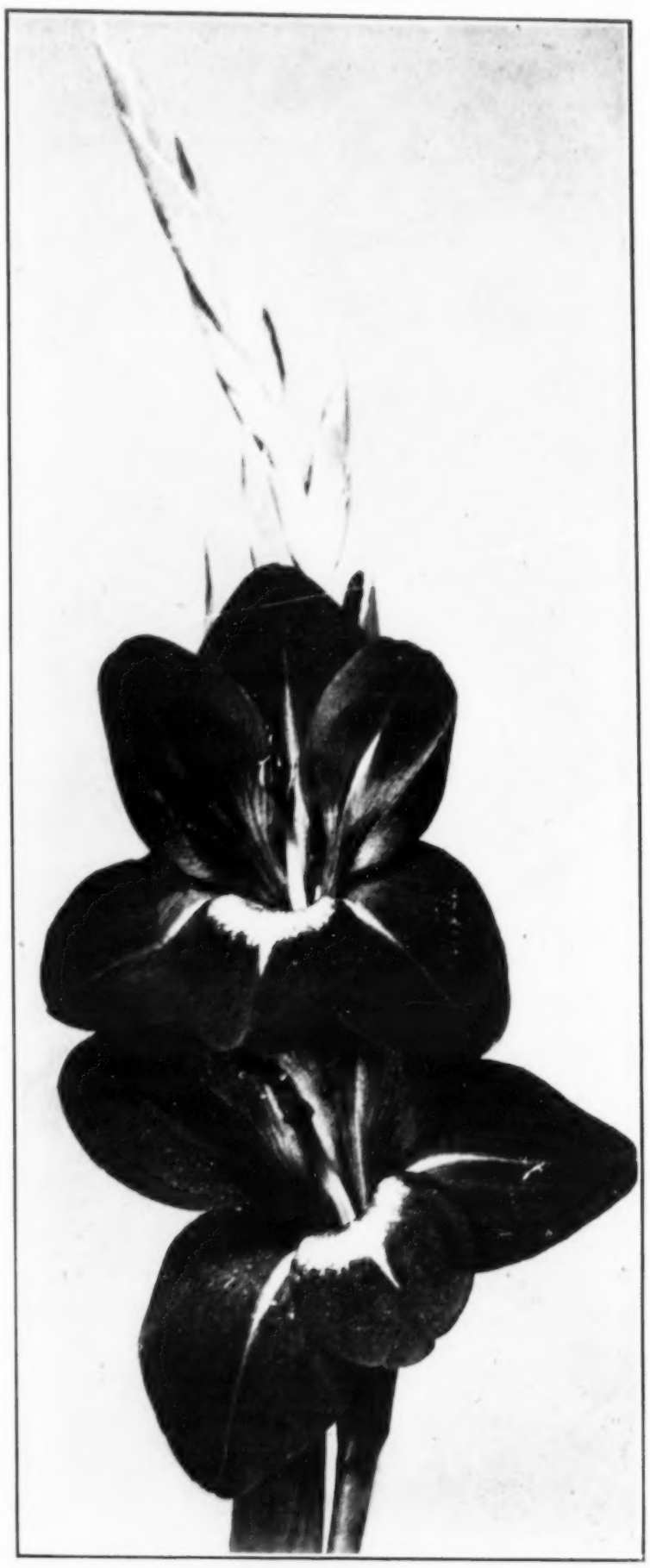
SAUNDERS' GLADIOLUS

This brilliant scarlet species (*G. saundersi*) has an amber white throat finely dotted. The openness of its throat is marked, and it has been particularly prized by hybridizers for that reason. It has been used in the creation of many modern garden varieties of gladiolus, to produce well open blooms and clear white throats. Adapted by Hottes from the Botanical Magazine. (Fig. 6.)

was *G. ramosus* (*G. oppositiflorus* by *G. cardinalis*) crossed with *G. psittacinus*. This is substantiated by the fact that the new form contained features from each. Louis Van Houtte obtained the stock and advertised it as *G. gandavensis*, naming it from Ghent, Belgium, and describing it in glowing terms as bearing majestic flowers, numbering eighteen to twenty, of the most charming vermilion, the inferior petals adorned with chrome, amaranth and brown. He writes: "All Ghent comes to admire it. In stateliness and color it exceeds all others we have among Gladioli."

Napoleon III was much interested in the amelioration and introduction of new plants, and so it was that *G. gandavensis* came into the possession of Souchet, gardener of the Emperor. Souchet worked with it, developed by hybridization and selection its form, color, size and arrangement of flowers until it became a valuable addition to our garden plants. *G. gandavensis* can be characterized as having many flowers open at the same time, being of great size and of good substance, having rich colors, handsome and somewhat angular form, often having light areas or penciling in the throat. The flowers are arranged in two rows on a tall spike in such a way that each flower appears attractive. The spikes are very erect and quite stiff.

Some few years previous to 1878 the species *G. purpureo-auratus* came to the attention of that master French horticulturist, Victor Lemoine, who began to use it with improved forms of *G. gandavensis*. By this time, the group had been materially improved by Souchet, Brunelet and Souillard. Lemoine immediately realized the possibilities of this species, which was introduced into France in 1872. *G. purpureo-auratus* is pale yellowish-green and bears upon the lower segments of the flower admirable diamond-shaped blotches of maroon. The flowers are bell-shaped, rather hooded, pendant, far apart and face one direction. The foliage is somewhat glaucous, narrow and stiff. The stems are slender, wiry and inclined to be curved. The corms bear many short underground stems



PRINCEPS

This amaryllis-like gladiolus is one of 2,000 produced by Dr. W. Van Fleet; its interesting pedigree can be seen at the end of the text. In color it is rich crimson with a magnificent, large, white throat. From the "Modern Gladiolus Grower." (Fig. 7.)

tipped by clusters of cormels. The flower was not beautiful, but Lemoine realized that combinations of the *G. gandavensis* varieties with this new species would result in something unique.

LEMOINE'S HYBRIDS

In 1878 Lemoine exhibited at the International Exhibition at Paris a number of these hybrids and called them *G. lemoinei*. The stems are wiry,

slender, graceful, inclined to be curved, but the spikes have the ability to open only a few blooms at one time. Many of the varieties have too strong a tendency toward being bell-shaped, to the extent that the interior of the flower is not readily seen. The flowers are rather smaller than *G. gandavensis*. The colors are exceedingly rich and the lower petals of the blooms are usually blotched, a feature gained from *G. purpureo-auratus*. The blotches are deep, velvety and very striking. Enthusiasts have ventured to say that some of the richest colorings in the plant kingdom are found in the lemoinei. *G. purpureo-auratus* is about the hardiest of the African species and has contributed this quality to the hybrids. Many of them are hardy, even in the region of New York City. A moment's consideration will show that the rich petal coloring has been derived from the species *G. psittacinus;* the blotch, hardiness and graceful stem from *G. purpureo-auratus;* and the vigor, erectness, and perhaps the great number of flowers, from *G. oppositiflorus*.

Lemoine's next work was to influence the form and colorations of the *G. lemoinei* by using the species *G. saundersi* which is truly a beautifully colored species, even in its unimproved form. The flowers are brilliant scarlet with a pure white center, finely dotted scarlet. They are very open, being faulty in this respect. The plants are dwarf and weak-stemmed; six to eight large hooded flowers are borne upon a stem usually less than 2 feet tall. The leaves are short and glaucous.

Using *G. saundersi* with the best varieties of *G. lemoinei*, a new group was introduced in 1886 named *G. nanceianus* from Lemoine's home, Nancy, France. *G. lemoinei* was used as the pollen parent. Reciprocal crosses did not appear to be identical. The *G. nanceianus* varieties are characterized by being very large (larger than *G. gandavensis* or *G. lemoinei*), very well open as contrasted with lemoinei. The open flower looks one in the face, as the side segments are spreading. The throat is marked with peculiar mottlings of fine, short strokes of contrasting color. The varieties vary much in vigor, some being exceptionally strong, others very weak. They are quite hardy. The colors are excellent, brilliant or subdued according to the variety.

Max Leichtlin, of Baden Baden, Germany, admiring the species *G. saundersi*, but realizing its faults, made a series of crosses with the *G. gandavensis* varieties and obtained a few rather pretty seedlings which he sold in 1882 to V. H. Hallock who, after ten years of hybridization and improvement, sold his stock to John Lewis Childs. In 1892, Childs placed these seedlings upon the market under the name of *G. childsi*. The *G. childsi* constitute a group of large, showy-flowered varieties which possess gigantic growth, rich colors, and pretty mottled throats. At first these were somewhat lacking in substance. Many of the varieties resemble *G. gandavensis* except that they are more open; others are quite like *G. nanceianus* except for the fact that the throats of the latter are richer and more often thickly marked.

G. turicensis has the same parentage as childsi, and was originated by M. Froebel of Zürich, Switzerland; but because it has not been widely developed nor advertized, it is not of great importance.

Dr. W. Van Fleet produced a form which is much like an amaryllis in its clear, deep red. It is a cross between a childsi variety, Mrs. H. Beecher, and *G. cruentus*, and is called variety *Princeps*.

THE MAID OF THE MIST

Recently there has come to the attention of the gladiolus breeder a species from the Rain Forest near Victoria Falls on the Zambesi River, which is pale golden-yellow, primula-scented, and known as the Maid of the Mist or *G. primulinus*. This species is rather straggling in form, often three to four feet tall, and bears four to five narrow, hooded, rather small flowers. With this species many of the finest varieties of the other groups are being hybridized. Several seedlings of unusual merit have resulted from a cross between this species and the ruffled gladiolus, the

MRS. FRANK PENDELTON

In the large flowers of this variety, salmon-pink with deep blood-red blotches in the throat, can be traced the influence of a number of distinct species of gladiolus. The form of bloom is that of *G. lemoinei*, the markings are from *G. purpureo-auratus*, while the stem comes from *G. gandavensis*. From the "Modern Gladiolus Grower." (Fig. 8.)

latter a development by A. E. Kunderd, of Goshen, Ind., who produced these charming varieties by selecting blooms showing a ruffled tendency. The ruffled-primulinus hybrids are exceedingly vigorous and of excellent colors. *G. primulinus*, according to Dr. Van Fleet, who has produced over 2,000 hybrids, is dominant over the deepest reds, subduing them to pure, soft, pleasing shades of orange, salmon and terra cotta, with deep and light yellow throats. Hybridized with the whites and light colors, the resulting progeny is cream, buff, ecru, lemon and canary, often without markings. Deep yellows, in which the blotches are eliminated, result from crosses with yellows of the other groups. Most of the hybrids inherit the hooded character.

It is interesting to note that it is mainly one species which has contributed the blue color to the hybrids. This species is *G. papileo*, a purple one.

Lemoine used his *G. lemoinei* and the result was a series of more or less blue hybrids very much resembling *G. lemoinei*.

The foregoing discussion has concerned only a few of the species used, but it is hoped that the historical facts presented will show that the garden gladiolus is a multiple hybrid, resulting from a series of species each valuable for one or more dominant characteristics. Does not this bring out strongly the advisability of using a larger range of species in other plants? Each species in the practical hybridist's mind represents certain desirable characteristics to be incorporated into a hybrid. Too often there are many unfavorable features, the consideration of which is entirely neglected.

It must be admitted that greater progress can often be made with the interbreeding of established varieties, but when new features are to be added, the employment of new species is quite advisable or imperative. These should be the basis of hybridization. As years pass, the inferior seedlings may be discarded, and the ideal form may be far removed from the wild species; but the ancestor is necessary.

PEDIGREE OF SOME IMPORTANT GARDEN GLADIOLI

G. tristis x G. cardinalis x ?

G. colvillei G. cardinalis mules x G. oppositiflorus

G. ramosus

G. hybr. cardinali-oppositiflorus x G. psittacinus

G. saundersii x G. gandavensis x G. purpureo-auratus

G. turicensis

G. cruentus x G. childsi

variety Princeps

G. papileo x G. lemoinei x G. saundersii

Blue Gladiolus G. nanceianus

New Publication Planned

In order to furnish greater opportunity for the publication of the results of research in genetics, the Princeton University Press is making plans to launch a new periodical to be called *Genetics*. It is hoped that the first number can appear in January, 1916. It will be under the control of a board of editors, chief of whom will be Dr. George Harrison Shull, of the Carnegie Institution, Cold Spring Harbor, Long Island, N. Y., who has recently resigned his position there to become associated with Princeton University. *Genetics*, it is announced, will accept only technical papers, the results of original research, and will therefore not conflict with the JOURNAL OF HEREDITY, whose function is rather to interpret the results of research to those who would profit by them, but are not in a position to follow the technical literature.

PROPAGATION OF WILD BIRDS

Waterfowl Very Easy to Breed in Captivity—Gallinaceous Species Offer no Great Difficulties—Benefits and Profits from Breeding—Bird Refuges

Review of a Book by

HERBERT K. JOB

Economic Ornithologist in Charge of the Department of Applied Ornithology of the National Association of Audubon Societies.

THERE seems to be among students of nature, nowadays, a widespread desire to assist nature in "running things." The plant lover is no longer content with inspecting the flowers of the field: he wants to grow them in his own garden, often under rigorously controlled conditions. The student of animal life is unlikely to spend all his time in the woods or meadows, as he often did a quarter century ago. If he wants to be in the fashion, zoölogically, he is too likely to spend all his time in a laboratory, and he will give preference to animals that can be kept in cages or tanks, for with them he will come as near as possible to seeing everything he wants to see.

For a long time the bird lovers stood out against this passion for breeding, which had taken hold of the botanists and zoölogists. Ornithologists continued to pursue their studies in the field, and there was little demand even for commercial breeding.

But in the last ten years, the students of birds, too, have succumbed to the desire to get nearer to nature than a stroll in the woods makes possible. All over the country they are using devices to attract the birds to their own dooryards; and those who possess means are in many cases undertaking breeding experiments on a large scale, sometimes as a commercial, sometimes as a sporting proposition.

So long as it does not lead to a neglect of wild life in its natural environment, the modern naturalist's desire to take up breeding deserves every encouragement. Plant and animal breeders have long been able to get abundant advice in printed form, and bird lovers are now to be congratulated on having a book,[1] "The Propagation of Wild Birds," which seems likely to meet their needs.

Herbert K. Job, its author, was formerly State Ornithologist of Connecticut, and is now in charge of the Department of Applied Ornithology of the National Association of Audubon Societies. Much of the success in rearing wild birds in captivity nowadays is based on Mr. Job's own experiments, and he describes them and others in a business-like way, so simply that no one can misunderstand.

The rearing of gallinaceous birds such as the quail, pheasant and turkey, is probably the most important, and for these, Mr. Job warns his readers, a good deal of room is necessary. "Experiment has shown conclusively that all kinds of wild gallinaceous birds can be kept in health in confinement. Most kinds cannot, however, with safety, be closely confined in *small* quarters, like domestic fowl. Under such conditions they are very susceptible to various diseases, especially of the digestive tract, which are likely to become epidemic. To these the domesticated species have become considerably immune. Some species require more room and range than any others and cannot stand any crowding. Another matter of importance is that the same ground surface must not be used for too long a period continuously."

[1] Propagation of Wild Birds, a Manual of Applied Ornithology, by Herbert K. Job. Pp. 276, illustrated. New York, Doubleday Page & Co., 1915.

CALIFORNIA OR VALLEY QUAILS

The birds which have made a friend of Ruth, daughter of Superintendent Dirks of the State Game Farm of California, belong to a different species from the "bob white" of the East; their plumed heads lend them an air of particular dignity. The California species gathers in large flocks, and has a gentle, confiding disposition which makes it well suited to breeding in captivity. From Job, "Propagation of Wild Birds." (Fig. 9.)

"When one has decided to raise birds, the question is how to secure breeding stock. In the case of various foreign species, notably pheasants and the gray or Hungarian partridge, these are readily purchased. With native species, however, the case is different. Most States have forbidden the shipment and sale of native game. There is an occasional game commissioner or chief warden who grants special permission to secure a few birds for propagation only.

"Though there is a real difficulty at present, the problem will undoubtedly soon be solved. Laws are being passed in various States to encourage, under proper supervision and regulation, the propagation of game as an industry. Many people are now making small beginnings, and before long will have breeding-stock for sale. The high prices for live birds will for some time to come make it more profitable to sell them for breeding than for food purposes, except with such common species as the ring-necked pheasant and the mallard."

A start could often be made with birds taken in the hunting season slightly wounded in the wing. Sometimes permission has been given to take a few eggs, which can then be hatched under a bantam. It is also possible to secure some birds, particularly quail, from Mexico, and contrary to expectation these have proved quite hardy in New York State.

Breeding the native quail or bob-white on a large scale is decidedly to be recommended, the author says, in view of the value of the bird to agriculturists as well as to sportsmen. The problems

in connection with it have been pretty thoroughly worked out; "the main thing has been to learn what precautions are necessary to avoid the outbreak of epidemic diseases."

Privacy is of primary importance with this bird. "They are exceedingly secretive in habits, particularly in mating and breeding, and skulk nearly all the time under cover, unless convinced that no observer is near."

AVOID OVERCROWDING

"In a 5 or 6 acre enclosure at the Clove Valley Club I saw 2,000 young phesants raised without danger. But quails would certainly not stand anything like that amount of herding. We do not yet know how far we can go with numbers and crowding, and this is to be worked out. Till this is done, it is well to be cautious with the rearing-field system, using, preferably, fields of moderate size and more of them. For the present, I should not try to keep more than half a dozen broods in a field of half an acre. For other broods it will be safer to scatter the coops in the open about the estate, preserve or farm."

Summarizing, Mr. Job advises that quail can be successfully bred as follows:

"1. Secure breeding stock in the late fall or early winter either by purchase or by capture of a small stock by permission of the authorities.

"2. Keep these through the winter in a wire enclosure with simple shelter from storms and cold winds.

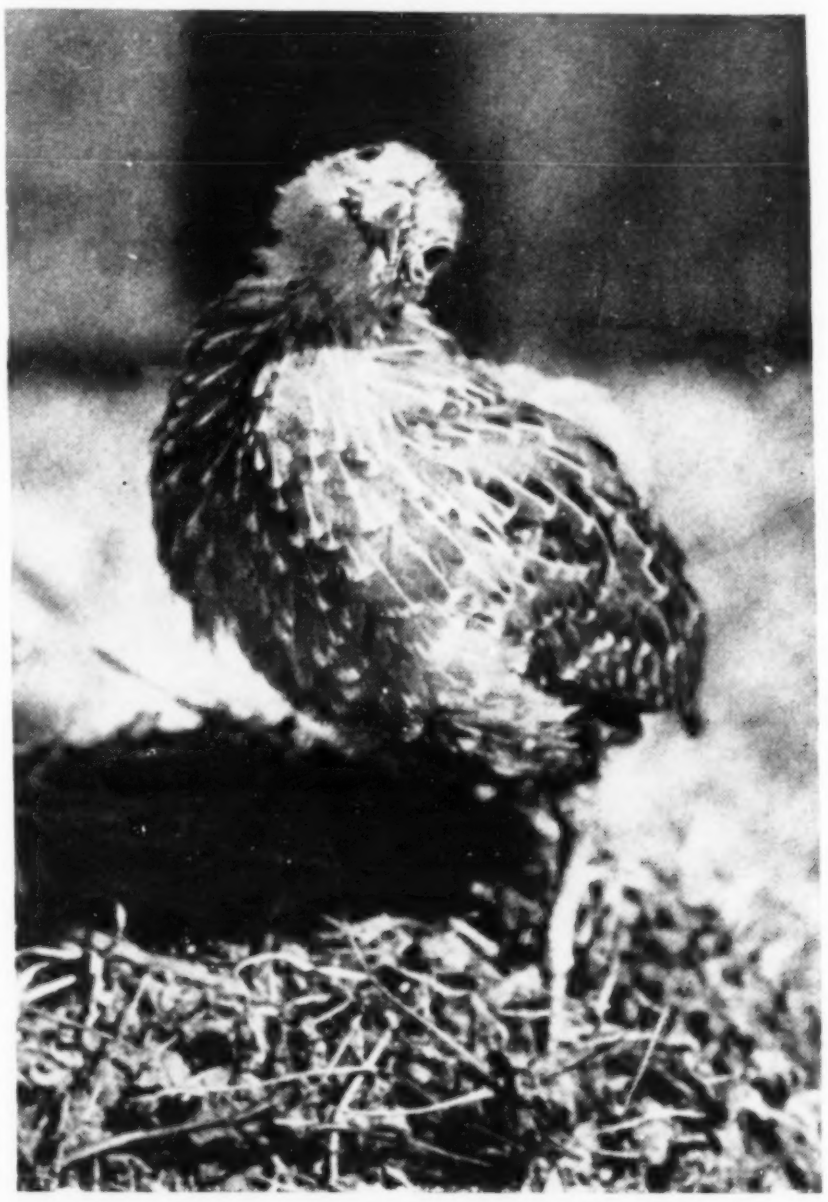
"3. In April separate the pairs, having each pair in a small pen by itself. Some can remain in the larger pen together, if there are not enough small pens.

"4. Hatch out the eggs and raise the young with bantams. Do not attempt incubators and brooders.

"5. Put the breeders back into the large pen together by the latter part of July, unless they wish to incubate.

"6. In late fall or early winter catch up what young are desired. The rest can be left wild to breed naturally next summer. Feed regularly under shelters throughout the winter, to hold them on the land, as also by planted areas of grain left standing for them. In severe winter weather coveys might be shut up and cared for, and let go again."

The grouse family, including the "partridge" and ptarmigan of the North, the "prairie chicken," the heathhen, etc., offers another attractive field. These birds become very tame in domestication—in fact, the tameness of young



YOUNG QUAIL WATCHING A FLY

Quails are usually reared in captivity from eggs incubated by bantam hens. Except for the possibility of certain contagious diseases, quail breeding offers no great difficulties, and is of great benefit from an agricultural as well as a sporting or commercial standpoint. From "Propagation of Wild Birds," by Job. (Fig. 10.)

which are hatched and bred in captivity is so great as to render them almost helpless under natural conditions, until they have had a chance to learn the ways of the wild.

THE WILD TURKEY

For many reasons, the wild turkey has attracted a number of breeders. It is not so near extinction, in a state of nature, as most people think, but it

YOUNG REDHEAD DUCKS IN MANITOBA

In order to learn, under the most favorable conditions, how to rear wild ducks in captivity, Mr. Job made two expeditions to Northern Canada. This photograph shows some of the young redheads, hatched in incubator from eggs found in nests in the woods, and then brought to maturity in brooder. Among the American wild ducks, he has found the redhead one of the easiest to raise, owing to its hardiness and docility. From Job, "Propagation of Wild Birds." (Fig. 11.)

deserves to be increased. Mr. Job declares that many of the birds now killed in the woods are hybrids with the domestic turkey, and that much of the breeding stock sold under the name of wild turkey is really of mongrel origin. The differences between the two forms are, of course, slight. The birds are easily domesticated, and when not crowded they appear to be little more difficult to rear than is the ordinary barn-yard turkey.

But the pheasant family, in Mr. Job's opinion, is preëminently the species for would-be propagators to begin with. It is more easily raised than any other game bird of the gallinaceous group, it is wonderfully hardy, and it has much commercial value. "At present indications it seems likely to become one of the principal game birds of America."

Methods are much the same as for quail. The birds will stand a good deal of crowding, though not so much as poultry. The large and brilliant birds are an attraction to any estate; furthermore they are distinctly profitable.

"It is a pleasant way for young people to make a little money on the side by raising a few game birds or waterfowl. With hardly any expense, on the average farm, a boy could have a few broods of pheasants roaming around and growing up. What little work there is will seem more like sport, and the watchfulness required is good training. After buying the original breeding stock, the expense is very light. Little apparatus is required, and the birds are small eaters. Ring-neck stock will probably cost $5 to $6 per pair in the late fall. A cock and four hens, say, might cost from $10 to $15. These should lay at the very least 120 eggs, which are worth usually 25 cents each, or more than double the cost of the original stock. If even a moderate number of young are reared and sold, the undertaking would considerably more than pay.

AN EXHIBIT "TO ENCOURAGE THE OTHERS"

Crows are often a pest to game breeders, because of their fondness for birds' eggs, and their tendency to destroy young birds. Although they do some good, the game breeder usually regards them as more of liability than an asset. A Connecticut farmer has killed a number of them and hung them on a tree as a warning to their brethren. From Job, "Propagation of Wild Birds." (Fig. 12.)

"The demand for live pheasants from the many that are beginning to breed them is so great that there is an almost unlimited market at present for them alive. When this demand is finally met, there is still an enormous field for sale for food purposes as wild game."

One of the difficulties which every breeder has to face is the activity of small animals which, however valuable they may be from some other point of view, are to the bird breeder merely "vermin."

WAR ON VERMIN

"A popular fallacy," Mr. Job remarks, "is that all it is necessary to do to increase bird life is to set apart a tract of wild land as a refuge, and prohibit trespass and shooting. At the start there are probably few birds, and after ten years there might not be any more. One reason is that the average wild land abounds with destructive vermin. Hawks and owls, which are the principal natural check upon the smaller mammals, have been so reduced in numbers that rats and other vermin abound. True they kill some birds, but they eat more of the enemies of the birds. Because we have upset the balance of nature, we have to help restore it by checking the abnormal increase of vermin." Practical suggestions for destroying these pests are given.

But if the breeding of gallinaceous birds offers no unsurmountable problems, waterfowl are still easier to rear, according to the author.

"The simplicity of the keeping of wildfowl is one of the delightful surprises in store, though it must be borne in mind that there will be failure unless certain fundamental principles are carried out. About all that is needed is a little pond or brook, especially in a

ROYAL TERNS FLOURISH UNDER PROTECTION

Breton Island, off the coast of Louisiana, has been set aside as a refuge for wild fowl, and is patrolled by the National Association of Audubon Societies, who take care that nothing shall interfere with the natural breeding of the birds. This photograph shows royal terns during the breeding season. Many such reservations have been established in all parts of the United States during recent years. From Job, "Propagation of Wild Birds." (Fig. 13.)

quiet, sheltered place and with some marshy ground, perhaps a simple, open-front poultry shed, and a cheap wire fence. The food also is simple and easy to provide. It is easy to maintain the birds in health, when properly handled, for they are hardy, and seldom have epidemics comparable to those of the gallinaceous birds, though similar disasters may occur if the water is allowed to become foul and stagnant and reasonable sanitation is not observed. The young also are comparatively easy to rear."

"Anyone who has even the facilities of a city back yard, with a cement basin and a little shrubbery, could have a few pairs of pinioned wild ducks which would breed in happy contentment. F. N. Manross, of Forestville, Conn., has a little artificial basin under the windows of his factory, surrounded by some thick, low shrubbery and a wire fence. There a pair of beautiful wood ducks, regardless of noise or human presence, each year raise a brood of young, and furnish their owner delightful distraction from business cares. A steam pipe keeps the water partly open in winter, and there they live the year round, with no shelter other than shrubbery and a small box. In another part of the yard he has a couple of pairs of Canada geese, originally wild, which live there in perfect contentment."

WILD GEESE EASILY TAMED

"It is a surprise to many who consider wild geese the type of inherent wildness that in reality they are tamed more readily than almost any other wild bird, even than ducks, submitting even in shorter time and becoming more absolutely familiar. This is notably true of the common wild goose or Canada goose. Wing-tipped geese which are captured will in a short time become so tame that they will hardly get out of the way.

"It is a curious anomaly, however, that while the Canada goose, as a species, breeds readily in captivity, all the other species of native wild geese

are very hard to breed, notwithstanding the fact that they all become perfectly tame."

Most of the wading birds are hard to breed, for various reasons, one of which is the amount they eat. Mr. Job describes his experience with a woodcock which weighed 6 ounces and consumed daily from 8 to 12 ounces of earthworms. Several boys spent their spare time digging worms for the bird, but after a month Mr. Job became disgusted and liberated him. As he says, the idea of feeding a whole flock of woodcocks staggers the imagination.

The same objection prevents the breeding of herons or egrets for their plumes. "The enormous appetite of herons for fish would make the thing commercially unprofitable even if herons were induced to breed in captivity. E. A. McIlhenny, of Avery Island, La., is experimenting now with herons in a large flying cage, to see if they will breed in captivity. He says that each bird eats 1½ pounds of fish a day, on the average, and it has cost $12 per year to feed each bird."

Cranes are readily kept in confinement, and it is becoming fashionable to have them on country estates. They are expensive, however, and do not breed.

BIRD REFUGES

One aspect of breeding which deserves note is the establishment of refuges and protected colonies. "A splendid movement, which has gathered momentum in the past few years, is the establishment of reservations on tracts of marsh and swamp land, unsuited to human occupancy, where wildfowl can gather and feed in winter and be safe from molestation. Well known already are the Ward-McIlhenny tract in Louisiana and that of Marsh Island, donated by Mrs. Russell Sage. Latterly comes the vast tract under the Rockefeller Foundation adjoining the above in this great marsh region. Together these comprise some 500 square miles, and extend for 75 miles along the coast. Already ducks have begun to breed there in considerable numbers, according to Mr. McIlhenny—the blue-winged teal, gadwall, black duck, and mallard, and probably others in time will join them. Similar measures should be taken, even if on a smaller scale, in every state of the Union. The wildfowl should also be protected on their breeding grounds, wherever these are located. Some breed in the United States, but most of them in the northwest provinces of Canada, and it is ardently to be hoped that through treaties with our neighbors, both on the north and south, a comprehensive continental protection and conservation of this important and valuable asset may be made possible."

There are already, Mr. Job notes, nearly sixty protected areas set aside in various parts of the country by the Federal Government, as water-bird breeding colonies. The National Audubon Society undertakes the work of policing them, and also guards various other rookeries which are not national reservations. Thousands of individuals are doing similar work on their own land.

The concluding portion of Mr. Job's book is given over to a description of means by which the smaller wild birds can be attracted and induced to remain around houses and on farms. To many readers, this is likely to be the most valuable and interesting part of the book. In this, as well as in the preceding sections, the author wastes little time on generalities, but gives detailed and specific directions for meeting each individual problem that is likely to arise.

Eugenics in the Colleges

Perhaps Kalamazoo College, in Michigan, can claim to have taught eugenics as long as any college in the United States. Professor W. E. Praeger, of the Department of Biology, writes that it has been a part of the curriculum for nine years. There has been a special course in genetics for the past three years; before that the subject was part of the course entitled Theoretical Biology. Lectures in eugenics are also given in the course on hygiene, required of all freshmen.

MATERNAL IMPRESSIONS

Belief in Their Existence Is Due to Unscientific Method of Thought—No Evidence Whatever That Justifies Faith in Them—How the Superstition Originated

THE EDITOR

IS THERE a short cut to eugenics? This association stands committed to the belief that eugenics is a phase of genetics; that it is, therefore, an applied science. Anything which calls itself eugenics, but which is not scientific, should expect only hostility from us.

To be scientific, nothing more is necessary than that a doctrine should be based on accurate observation of facts, and correct inferences from those facts.

As the experience of most of us is limited, and as our beliefs and reasoning are unconsciously influenced by our hopes and fears, and by prejudices which we absorb during childhood, it is no cause for astonishment that some ideas should be widely current and accepted almost without protest which, when examined by a really scientific method of thought, seem absurd. I wish to apply this process to a very widespread popular belief, which is being urged by many sincere and often influential persons as a "short cut" method of race betterment.

I refer to what is commonly called maternal impression, pre-natal culture, "marking," and so on. It is no novelty, but goes back beyond history. In the book of Genesis[1] we find Jacob making use of it to get the best of his tricky father-in-law. Some animal breeders still profess faith in it as a part of their methods of breeding: if they want a black calf, for instance, they will keep a white cow in a black stall, and express perfect confidence that her offspring will resemble midnight darkness.

It is easy to see that this method, if it "works," would be a potent instrument for eugenics. And it is being recommended for that reason. Says a recent writer, who professes on the cover of her book to give a "complete and intelligent summary of all the principles of eugenics:"

"Too much emphasis cannot be placed upon the necessity of young people making the proper choice of mates in marriage; yet if the production of superior children were dependent upon that one factor, the outlook would be most discouraging to prospective fathers and mothers, for weak traits of character are to be found in all. But when young people learn that by a conscious endeavor to train themselves, they are thereby training their unborn children, they can feel that there is some hope and joy in parentage; that it is something to which they can look forward with delight and even rapture; then they will be inspired to work hard to attain the best and highest that there is in them, leading the lives that will not only be a blessing to themselves but to their succeeding generation."

MANY ADHERENTS

The author of this quotation has no difficulty in finding supporters. Many physicians and surgeons, who are supposed to be trained in scientific methods of thought, will indorse what she says. The author of one of the most recent and in many respects admirable books on the care of babies, a woman who

[1] Chapter XXX, verses 31–43. A knowledge of the pedigree of Laban's cattle would undoubtedly explain where the stripes came from. It is interesting to note how this idea persists: I had just completed the present paper when I received from a correspondent the account of seven striped lambs born after their mothers had seen a striped skunk. The actual explanation is doubtless that suggested by Heller in the JOURNAL OF HEREDITY, VI, 480 (October, 1915), that a stripe is part of the ancestral coat pattern of the sheep, and appears from time to time because of reversion.

occupies a position of national importance in the "Better Babies" movement, is almost contemptuous in her disdain for those who think otherwise:

"Science wrangles over the rival importance of heredity and environment, but we women *know* what effects prenatal influence works in children." "The woman who frets brings forth a nervous child. The woman who rebels generally bears a morbid child." "Self-control, cheerfulness and love for the little life breathing in unison with your own will practically insure you a child of normal physique and nerves."

Such statements, backed up by a great array of writers and speakers whom the layman supposes to be scientific, and who think themselves scientific, cannot fail to influence strongly an immense number of mothers and fathers. If they are truly scientific statements, their general acceptance must be a great good.

But think of the disillusionment if these widespread statements are false!

Have we, or have we not, a short cut to race betterment? Everyone interested in the welfare of the race must feel the necessity of getting at the truth in the case; and the truth can be found only by rigorously scientific thought.

Let us turn to the observed facts. I find this sample in the health department of a popular magazine, quite recently issued:

"Since birth my body has been covered with scales strikingly resembling the surface of a fish. My parents and I have expended considerable money on remedies and specialists without deriving any permanent benefit. I bathe my entire body with hot water daily, using the best quality of soap. The scales fall off continually. My brother, who is younger than myself, is afflicted with the same trouble, but in a lesser degree. My sister, the third member of the family, has been troubled only on the knees and abdomen. My mother has always been quite nervous and susceptible to any unusual mental impression. She believes that she marked me by craving fish, and preferring to clean them herself. During the prenatal life of my brother, she worried much lest she might mark him in the same way. In the case of my sister she tried to control her mind. Could we transmit this condition[2] to our children?"

THE MARK OF THE MEAT MARKET

Another I find in a little publication which is devoted to eugenics.[3] As a "horrible example" we are given the case of Jesse Pomeroy, a murderer whom older readers will well remember. His father, it appears, worked in a meat market. Before the birth of Jesse, his mother went daily to the shop to carry a luncheon to her husband, and her eyes naturally fell upon the bloody carcases hung about the walls. Inevitably, the sight of such things would produce bloody thoughts in the mind of the child!

These are extreme cases; let me quote from a medieval medical writer another case that carries the principle to its logical conclusion: A woman saw a negro—at that time a rarity in Europe. She immediately had a sickening suspicion that her child would be "marked," that he would be born with a black skin. To obviate the danger, she had a happy inspiration—she hastened home and washed her body all over with warm water. When the child appeared, his skin was found to be normally white—except between the fingers and toes, where it was black. His mother had

[2] Such a skin affection is usually due to heredity. Davenport says it "is especially apt to be found in families in which consanguineous marriages occur and this fact, together with the pedigrees [which he studied], suggests that it is due to the absence of some factor that controls the process of cornification of the skin. On this hypothesis a normal person who belongs to an affected family may marry into a normal family with impunity, but cousin marriages are to be avoided." Technically the disease is known as icthyosis, xerosis or xerodoma. See Davenport, C. B., Heredity in Relation to Eugenics, p. 134. New York, 1911.

[3] Of course, their eugenics is to be effected through the mental exertion of mothers. And I am now in correspondence with a western attorney who is endeavoring to form an association of persons who will agree to be the parents of "willed" children. By this means, he has calculated (and sends me a chart to prove it) that it will require only four generations to produce the Superman.

failed to wash herself thoroughly in those places!

Of course, few of the cases now credited are as gross as this; but the principle involved remains, so far as I can see, the same.

We will take a hypothetical case of a common sort for the sake of clearness: the mother receives a wound on the arm; when her child is delivered it is found to have a scar of some sort on the corresponding arm, and at about the same place. Few mothers would fail to see the result of a maternal impression here. But how could this mark have been transmitted? We are not here concerned with the transmission of acquired characters through the germ-plasm, or anything of that sort, for the child was already formed when the mother was injured. We are driven, therefore, to believe that the injury was in some way transmitted through the placenta, the only connection between the mother and the unborn child; and that it was then reproduced in some way on the child, at a place corresponding to that where it appeared in the mother.

NO MEANS OF TRANSMISSION

Here we have a situation which, examined in the cold light of reason, puts a heavy enough strain on the credulity. But what most mothers may forget is that there is not a single nerve or blood-vessel passing through the placenta, from mother to child. Not a drop of the mother's blood passes to her unborn offspring. The child does indeed derive all its nourishment from the mother, but it is by soakage from her blood to its own; there is no direct connection. No one has ever traced a single nerve or blood vessel passing through. Is it conceivable to any rational human being, that a scar, or what not, on the mother's body (or mind), can be dissolved in her blood, soak through the placenta into the child's circulation, and then gather itself together into a definite scar on the infant's arm?

There is just as much reason to expect the child to grow to resemble the cow on whose milk it is fed after birth, as to expect it to grow to resemble its mother, because of pre-natal influence, as the term is customarily used—for once development has begun, the child draws nothing more than nourishment from its mother.

Of course we are accustomed to the pious rejoinder that man must not expect to understand all the mysteries of life; we are accustomed to hearing vague talk about the wonder of wireless telegraphy. But in wireless telegraphy we have something very definite and tangible—there is little mystery about it. We have waves of a given frequency sent off, and caught by an instrument attuned to the same frequency. How any rational person can support a belief in maternal impressions by such an analogy, if he knows anything about anatomy and physiology, passes comprehension.

Now I am far from declaring that we can find a reason for everything that happens. Science will not refuse belief in an observed fact merely because it is unexplainable. But let us examine this case of maternal impressions a little farther. What can we learn of the time element?

THE TIME ELEMENT

Immediately we are confronted with the significant fact that most of the marks, deformities and other effects which are credited to pre-natal influence must *on this hypothesis* take place at a comparatively late period in the ante-natal life of the child. The mother is frightened by a dog; the child is born with a dog-face. If we ask *when* her fright occurred, we usually find it not earlier than the third month, more likely somewhere near the sixth.

But it ought to be well known that the development of all main parts of the body has been completed at the end of the second month. At that time, the mother rarely does more than suspect the coming of a child. Her anxiety about the child, and events which she believes to "mark" that child, usually occur after the fourth or fifth month, when the child is fully formed, and it is *impossible* that many of the effects supposed to occur could

actually occur. Indeed, we now believe that most errors of development, such as lead to the production of great physical defects, are due to some cause within the embryo itself, and that most of them take place in the first two or three weeks, when the mother is by no means likely to influence the course of embryological development by her mental attitude toward it, for the very good reason that she knows nothing about it.

Unless she be immured or isolated from the world, nearly every expectant mother sees many sights of the kind that, according to popular tradition, cause "marks." Why is it that results are so few? Why is it that women doctors and nurses, who are constantly exposed to unpleasant sights, have children that do not differ from those of other mothers?

Darwin, who knew how to think scientifically, saw that this is the logical line of proof or disproof. When Sir Joseph Hooker, the botanist and geologist who was his closest friend, wrote of a supposed case of maternal impression, one of his kinswomen having insisted that a mole which appeared on her child was the effect of fright upon herself for having, before the birth of the child, blotted with sepia a copy of Turner's "Liber Studiorum" that had been lent her with special injunctions to be careful, Darwin[4] replied: "I should be very much obliged, if at any future or leisure time you could tell me on what you ground your doubtful belief in imagination of a mother affecting her offspring. I have attended to the several statements scattered about, but do not believe in more than accidental coincidences. W. Hunter told my father, then in a lying-in hospital, that in many thousand cases he had asked the mother, *before her confinement*, whether anything had affected her imagination, and recorded the answers; and absolutely not one case came right, though, when the child was anything remarkable, they afterwards made the cap to fit."

Any doctor who has handled many maternity cases can call to mind instances where every condition was present, to perfection, for the production of a maternal impression, on the time honored lines. None occurred. Most mothers can, if they give the matter careful consideration, duplicate this experience from their own. Why is it that results are so rare?

THE SEARCH FOR COINCIDENCE

That Darwin gave the true explanation of a great many of the alleged cases is perfectly clear to us. When the child is born with any peculiar characteristic, the mother hunts for some experience in the preceding months that might explain it. If she succeeds in finding any experience of her own at all resembling in its effects the effect which the infant shows, she considers she has proved *causation*, has established a good case of pre-natal influence.

It is not causation; it is coincidence.

If the prospective mother plays or sings a great deal, with the idea of giving her child a musical endowment, and the child actually turns out to have musical talent, the mother at once recalls her yearning that such might be the case; her assiduous practice which she hoped would be of benefit to her child. She immediately decides that it did benefit him, and she becomes a convinced witness to the belief in pre-natal culture. Has she not herself demonstrated it?

She has not. But if she would examine the child's heredity, she would probably find a taste for music running in the germ-plasm. Her study and practice had not the slightest effect on this hereditary disposition; it is equally certain that the child would have been born with a taste for music if its mother had devoted eight hours a day for nine months to cultivating thoughts of hatred for the musical profession and repugnance for everything that possesses rhythm or harmony.

It necessarily follows, then, that attempts to influence the development of the child, physically or mentally, through "pre-natal culture," are doomed to disappointment. The child develops along the lines of the potentialities which existed in the two germ cells that united to become its origin. The

[4] Life and Letters of Charles Darwin, Vol. I, p. 302, New York, 1897. The letter is dated 1844.

course of its development cannot be changed in any definite way by any act or attitude of his mother.

It must also necessarily follow that attempts to improve the race on a large scale, by the general adoption of pre-natal culture as an instrument of eugenics, are useless.

Indeed, the logical implication of the teaching is the reverse of eugenic. It would give a woman reason to think she might marry a man whose heredity was rotten, and yet, by pre-natal culture save her children from paying the inevitable penalty of this weak heritage. We have long shuddered over the future of the girl who marries a man to reform him; but think what it means to the future of the race if a superior girl, armed with correspondence school lessons in pre-natal culture, marries a man to reform his children!

MISSPENT ENERGY

Those who practice this doctrine are doomed to absolute disillusion. The time they spend on pre-natal culture is not cultivating the child; it is merely cultivating a superstition. Not only is their time thus spent wasted, but worse, for they might have employed it in ways that really would have benefited the child—in open-air exercise, for instance.

For those who preach this doctrine, with the belief that they are aiding the prospective mother or furthering the improvement of the race, we must feel sympathy and pity, as for all misguided efforts at well-doing.

Their only excuse for this divorce from science is failure either to recognize the facts involved, or to make correct inferences from these facts. That the latter explanation applies in most cases, we know because we find many persons holding a belief in the reality of maternal impressions, who are perfectly well aware of the facts in the case. And these facts, which they well know, seem to me wholly to preclude any deductions which will support the belief that pre-natal culture is anything better than a superstition. To recapitulate, the facts are:

(1) That there is, before birth, no connection between mother and child, by which impressions on the mother's mind or body could be transmitted to the child's mind or body.

(2) That in most cases the marks or defects whose origin is attributed to maternal impression, must necessarily have been complete long before the incident occurred which the mother, after the child's birth, ascribes as the cause.

(3) That these phenomena usually do not occur when they are, and by hypothesis ought to be, expected. The explanations are found after the event, and that is regarded as causation, which is really coincidence.

These facts, accompanied by the application of rigorous logic, seem to me to prevent anyone from accepting as true the current belief in maternal impressions.

And yet, because it is logically impossible to prove a universal negative, we cannot absolutely prove that such a thing as a maternal impression never happened and never can happen. We can only appeal to each individual to exercise his capacity for scientific thought, with an open mind, and decide for himself whether it is absurd to believe that the strawberry mark on the child's arm is due to his mother's appetite for strawberries.

But is it conceivable, we are often asked, that such an idea would have survived, widespread in the human race, for so many thousands of years, unless there were some basis of truth under it?

HOW THE IDEA AROSE

Certainly there is a basis of truth under it. The embryo derives its entire nourishment from the mother; and its development depends wholly on its supply of nourishment. Anything which affects the supply of nourishment will affect the embryo *in a general, not a particular* way.

Now if the mother's mental and physical condition be good, the supply of nourishment to the embryo is likely to be good, and development will be normal.

If, on the other hand, the mother is constantly harassed by fear or hatred, her physical health will suffer, she will be unable properly to nourish her developing offspring, and it, when born, may by its poor physical condition indicate this.

Further, if the mother experiences a great mental or physical shock, it may so upset her health that her child is not properly nourished, its development is arrested, mentally as well as physically, and it is born feebleminded. Goddard, for example, tells[5] of a high-grade imbecile in the Training School at Vineland, N. J. "Nancy belongs to a thoroughly normal, respectable family. There is nothing to account for the condition unless one accepts the mother's theory. While it sounds somewhat like the discarded theory of maternal impression, yet it is not impossible that the fright and shock which the mother received may have interfered with the nutrition of the unborn child and resulted in the mental defect. The story in brief is as follows: Shortly before this child was born, the mother was compelled to take care of a sister-in-law who was in a similar condition and very ill with convulsions. Our child's mother was many times frightened severely as her sister-in-law was quite out of her mind. She says that this child's ways often recall to her the sister-in-law's actions at that time."

We can easily understand that any event which makes such an impression on the mother as to affect her health, might so disturb the normal functioning of her body that her child would be badly nourished, or even poisoned. Such facts are not antagonistic to scientific thought; and they undoubtedly form the basis on which the airy fabric of pre-natal culture was reared by the hands of those who lived before the days of scientific biology.

ALLEGED CASES EXPLAINED

Thus, it is easy enough to see the real explanation of such cases as those mentioned by the "Better Babies" expert, near the beginning of this paper. The mothers who fret and rebel over their maternity, she found, are likely to bear neurotic children. It is obvious (1) that mothers who fret and rebel are quite likely themselves to be neurotic in constitution, and the child naturally gets his heredity from them; (2) that constant fretting and rebellion would so affect the mother's health that her child would not be properly nourished.

When, however, she goes on to draw the inference that "self-control, cheerfulness and love . . . will practically insure you a child normal in physique and nerves," we are obliged to stop. We know that what she says is not true. If the child's heredity is bad, neither self-control, cheerfulness, love, nor anything else known to science, can make that heredity good.

At first thought, we may wish it were otherwise. There is something inspiring in the idea of a mother overcoming the effect of heredity by the sheer force of her own will-power. But the idea is merely a hallucination, and perhaps in the long run it is as well: for there are advantages on the other side. It should be a satisfaction to mothers to know that their children will not be marked or injured by untoward events in the ante-natal days; that if the child's heredity cannot be changed for the better, neither can it be changed for the worse.

The pre-natal culturists and maternal-impressionists are trying to place on her a responsibility which she need not bear.

Obviously, it is the mother who is most nearly concerned with the bogie of maternal impressions, and it should make for her peace of mind to know that it is nothing more than a bogie.

It is important for the expectant mother to keep herself in as nearly perfect condition as possible, both physically and mentally. Her bodily mechanism will then run smoothly, and the child will get from her blood the nourishment needed for development, in proper quantity and proper quality. Beyond that, there is nothing the mother can do to influence the development of her child. There is not a shred of evidence to support the idea that

[5] Goddard, H. H. Feeblemindedness, p. 359. New York, the Macmillan Company, 1914.

a child's mental or physical character can be influenced in the slightest degree for better or for worse *in any definite way*, by the mental attitude of the mother before its birth.

Maternal impressions and pre-natal culture are not facts, but superstitions. They owe their continued existence to a lack of scientific thought. To realize their falsity, no deep researches are necessary: nothing more is needed than a knowledge of some elementary facts, and scientific thought about those facts.

Scientific thought, Clifford[6] told us, "is not an accompaniment or condition of human progress, but it is human progress itself."

No one, I venture to declare, has human progress more at heart than has the eugenist. It must, therefore, be to the interest of every eugenist to see that the superstition of maternal impression is driven out of existence.

[6] Clifford, W. K. The Aim and Instruments of Scientific Thought. Address before the British Association for the Advancement of Science, at Brighton, August 19, 1872.

International Congress of Genealogy

The International Congress of Genealogy which met in connection with the Panama-Pacific International Exposition in San Francisco from July 27 to 30, represented sixty-five genealogical, historical, patriotic, heraldic and family associations and had accredited to it about 275 delegates elected by these organizations. In addition, there were many others interested in genealogy, but not officially accredited, who attended the congress. The Utah Genealogical Society sent to the meeting a special train carrying 269 persons from Utah.

The program provided that the congress should meet the week following the national convention of the American Historical Association and the week preceding the annual meeting of the American Genetic Association and the Second International Conference of Race Betterment. It also provided for meetings in San Francisco of family associations during or as near as possible to the time of the genealogical congress. Some of the latter were held.

This plan and the genealogical congress, first of its kind ever held, were proposed by the Hon. Boutwell Dunlap, of San Francisco, recording secretary of the California Genealogical Society. He first proposed an International Congress of Genealogy and Eugenics. Not desiring to conflict with other eugenic organizations, the name of the congress was later restricted to the International Congress of Genealogy. The invitations to the congress and family associations were issued jointly in the names of the Panama-Pacific International Exposition and the California Genealogical Society.

Some of the organizations that elected delegates to the congress were the National Society of Americans of Royal Descent, Society for the Preservation of New England Antiquities, College of Arms and Seigneural Court of Canada, American Society of Colonial Families, New England Historic Genealogical Society, Huguenot Society of America, Louisiana Historical Society, Maine Genealogical Society, Historical Society of New Mexico, Order of Founders and Patriots of America, Society of Genealogists of London, National Genealogical Society, National Society of the Sons and Daughters of the Pilgrims, National Society of Sons of the Revolution.

An International Genealogical Federation was formed and a resolution affecting eugenics, introduced by Mr. Dunlap and unanimously adopted by the congress, was as follows:

"Resolved, that one of the objects of the International Genealogical Federation shall be the collection and preservation of genealogical data for eugenic purposes and that the committee of organization of said International Genealogical Federation is hereby instructed to provide for the said collection and preservation of genealogical data for eugenic purposes."

ANCESTRY OF THE GOAT

Modern Breeds All Descendants of a Single Species—Great Success Attained in Breeding This Species in Two Distinct Directions, for Milk and Hair

OF ALL important domesticated animals, the goat is distinguished by the simplicity of his ancestry. The modern horse, or ox, or dog, or sheep, is the product of the combination of a number of distinct species, but the European goat can trace his pedigree directly back to a single form.

It is, then, a matter of particular interest to breeders, to see what wide variations have been produced within the limits of one species, under domestication.

Geologically speaking, both the goats and their near relatives the sheep, were late in appearing on the earth. There must be a form somewhat intermediate between sheep, goats and antilopes, which we do not now know, but the first goat fossils, according to R. Lydekker, are of species allied to those now living in the Himalayas, and are found in Pliocene or late Tertiary deposits in the Panjab and the Siwalik hills of India. In the succeeding or Pleistocene epoch, remains of an ibex, one of the best-known wild goats, are found in the plains of Central Europe.

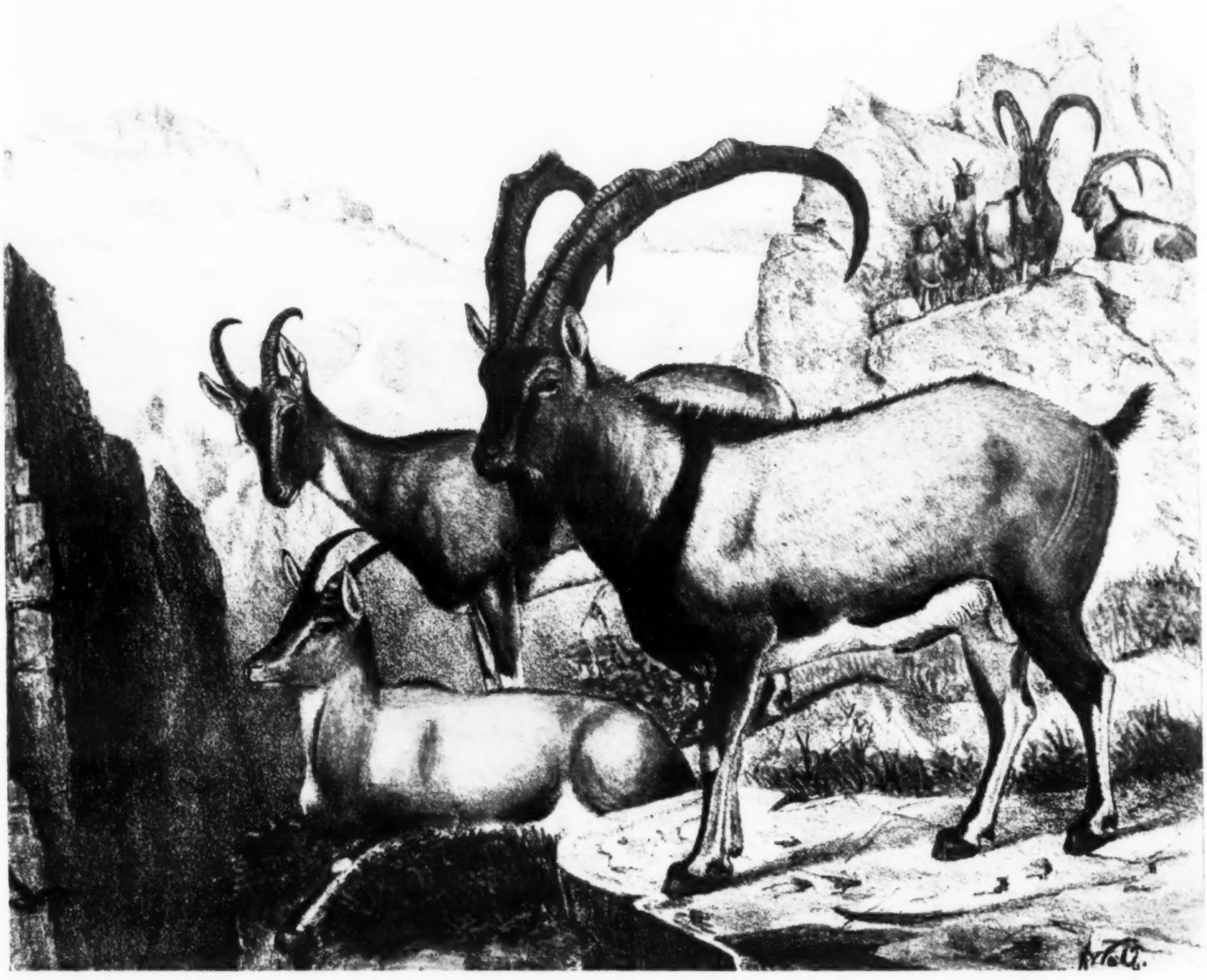
The distinction between sheep and goats was thus made at a comparatively late time in the history of the earth: even now it is not a broad one, for although the typical domesticated goat is distinguished without difficulty from the typical domesticated sheep, there are wild forms which stand almost half way between the two. The blending of the two species has always been the despair of zoölogists, who sought for some well-marked characters to distinguish them. The great French naturalist, Sanson, after discarding one by one all the characters which he studied, finally reached the desperate conclusion that the tail was the only feature by which a goat could be told from a sheep, that member, as every one knows, being short and erect in the goats, moderately long and carried in the normal position by sheep.

A GENETIC TEST

Proposals to lump the sheep and goats as a single genus have been frequently put forward, but always rejected by the body of zoölogists, largely, it may be believed, on the ground of convenience. To a genetist, the question would depend partly on whether the two forms breed together and result in fertile offspring. This is one of the moot points of animal husbandry—a somewhat astonishing fact, considering how many opportunities there should be for getting information.

On the one hand, there are those who claim that a real hybrid between the two forms is unknown; on the other we have stories of districts in Russia and Chile (or other parts of South America) where it is alleged that a hybrid form makes up the bulk of the flocks. Examinations of some of these flocks by zoötechnists have led to conflicting opinions as to whether they were really hybrids or not.

In the *American Breeders' Magazine* for 1913 (Vol. IV, No. 1, p. 69), W. J. Spillman, of the U. S. Department of Agriculture, described and figured an animal raised by E. Arnaud, of Monet, Mo., which he believed to be a true sheep-goat hybrid; it was one of a pair, and its twin was distinctly an ordinary sheep. Similar cases have often been reported, but even if they are accepted, they must be regarded as isolated, and it seems fair to say that interbreeding of the sheep and goat is at least very rare; whereas the different species of



ANCESTOR OF THE GOAT

Pasang or Grecian Ibex, a wild goat found in Asia Minor, Persia and adjoining countries. It is the belief of naturalists that this form, which is easily tamed, was domesticated at some time before the dawn of history and has given rise to all the numerous breeds of goat now found in Europe and America. Its improvement appears to have been by simple selection in two directions—to increase the yield of milk and to increase the yield of hair. From Lydekker. (Fig. 14.)

wild and tame goats interbreed freely and yield perfectly fertile progeny.[1]

To the genetist, then, the evidence that sheep and goats should be separated is fairly good. Zoölogists have found a few other characters that serve them more or less constantly: for example, the face of the goat has no crumen or tear-bag, which is usually, though not invariably, present on that of the sheep. And whereas all sheep have pores or glands between the hoofs of each foot, in the goats such glands are found only in the forefeet, and even there may be wanting.

The beard of the male, and the characteristic odor, are signs of great convenience to the layman in distinguishing goats from sheep.

The goat genus (*Capra*) is generally credited with a dozen species, and among these it is almost the consensus of opinion that a single one may be considered the ancestor of European (and

[1] L. L. Heller, of the Bureau of Animal Industry, U. S. Department of Agriculture, informs me that the bureau some years ago tried crossing goats with sheep, both males and females of each species being used. The breed of sheep chosen was the Barbados, as primitive in type as any in the United States, and it was thought that this breed should prove fertile in crosses with goats, if any would. There were no offspring from any of the matings. Mr. Heller believes the so-called hybrids that have been produced from time to time are merely reversions.—THE EDITOR.

MALE, IMPROVED TYPE OF MILK GOAT

The greatest development of goats for milk has taken place in Switzerland, where the two famous breeds, Toggenburg and Saanen, were produced. The photograph of Toggenburg Bill No. 442 shows a typical buck of the former breed. Good does of this breed will produce several quarts of rich milk daily, while one owned in California has set a world record with a daily production of six quarts—a record which thousands of cows in the United States fail to attain. Photograph from the U. S. Department of Agriculture. (Fig. 15.)

thence. American) domesticated goats. This is variously known as the Bezoar,[2] Pasang[3] or Grecian Ibex, while the zoölogists have an even greater range of synonyms, *Capra hircus aegagrus* being now the most widely accepted technical name.

THE PASANG AT HOME

Once common throughout Greece and Asia Minor, as is shown by its mention in Homer, the Pasang has now been crowded back, although it still lives on a few of the Mediterranean islands, notably on the slopes of Mount Ida in Crete. Its habitat today may be said to be Persia, Afghanistan and Baluchistan, although it is by no means extinct in the mountains of Asia Minor.

The slender, graceful animal, whose height at the shoulder is approximately three feet, is well shown in the accompanying drawing (Fig. 14). The general ground color of the upper parts is

[2] Bezoar is properly the name of a product in high repute among medieval medical men; it is a compound of bile and rosin, which forms a concretion in the stomach of the goat, and thence gave its name to the species from which it was most often obtained. The name is properly pa-zahr, from pao, to purify, and zahr, poison, and these "stones" were believed to have the power to draw poison from the bite of a snake, the sting of a scorpion, etc. There is still some commerce in them in India and other parts of the orient. Needless to say, they are valueless for medicinal purposes; and they are so easily counterfeited by a compound of pipe-clay and ox-gall that the market for them is in a bad state.

[3] Pasang means "rock-footed" and is supposed to be the Persian designation of this species; but as a fact it appears nowadays to be called merely boz-i-kohi, "mountain goat."

brownish-gray in winter, reddish-brown in summer, becoming paler in old males; the under parts are whitish.

It ranges solitary or in parties of from ten to twenty up to a hundred. "During summer," says Lydekker,[3] "the old bucks keep to the higher mountains, being frequently found in snow, while the does and kids frequent lower elevations. In winter both sexes keep more together, living at elevations of from 2,000 to 3,000 feet, on rocky ground among bushes or scattered pines. In certain districts they may descend almost to sea level.

"Although at other times shy and wary, during the pairing season they may be approached with ease and may be attracted within range by a concealed hunter rolling a few stones down the hillside. If surprised they utter a short snort and immediately make off in a canter. Their agility among rocks is little short of marvelous, but if driven down to the lowlands they can be easily caught with dogs, as is done in Afghanistan. When danger threatens, the oldest male takes command of the herd, and carefully surveys the line of advance or retreat before permitting the others to follow. Grass, the young shoots of dwarf oaks and cedars, and berries constitute their staple food in these districts. The kids, which are usually either one or two in number, are born in May."

The Pasang is easily domesticated, and the first domestication must have been thousands of years ago. This probably took place in Western Asia; from thence, Lydekker thinks, it was carried over into Africa, where it has departed very widely from the original type.

ARRIVAL IN EUROPE

Presumably the animal was brought into Europe by some of the earliest immigrants, but whether from Africa or from Asia, no one can say with confidence. Its remains are abundant in the early period of the Swiss lake dwellings, which go back perhaps as far as 4,000 B.C., but in the later part of this period they become rarer, indicating that the goat industry suffered a decline in those times. This, it is suggested, was due to the increasing prosperity of the population; for the goat has always been "the poor man's cow," and even today it is noticed that among African natives, goats are kept by the poorer tribes, but as they increase in prosperity they tend to give up goats and take to sheep instead.

The goat of the Swiss lake dwelling, according to C. Keller,[5] was somewhat smaller than the modern animal, and had horns. But there is some evidence that the goat of the Bronze Age was larger than that of the Stone Age, undoubtedly due to the selection of prehistoric breeders.

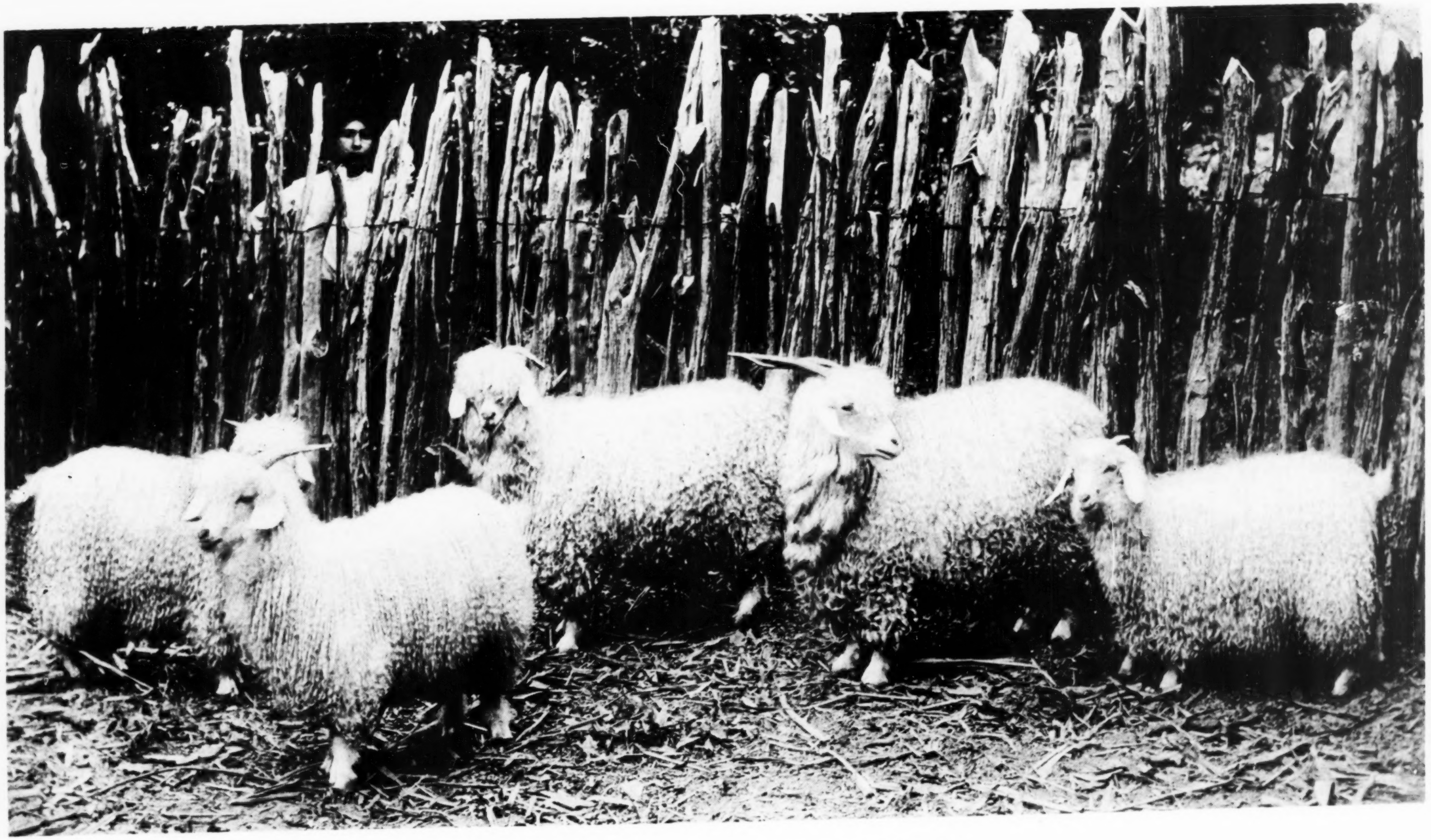
In the Roman period, a distinctly new form appears, an improvement of the old one, which nevertheless had not disappeared. This new form, as far as can be judged from the remains, was a sort of "thoroughbred;" it was, says Keller, unquestionably a product of conscious breeding and artificial selection, and seems to have come up from the Mediterranean lands. It is little different, he declares, from some of the types still to be found in Switzerland.

In the early days of Greece, goats were widely kept, as is proved by evidence of many kinds, but by the advent of the classical period, the industry had shrunk and been largely supplanted by sheep.

"In the kingdom of the Pharaohs the goat breeding was of great importance, for we learn from extant documents that a landlord received from his superintendent 5,023 head of live stock, of which 924 were sheep and 2,234 goats; the goat industry was therefore of considerable size. Lumbermen felling sycamores, whose trunks furnished wood for coffins and other purposes, took goats with them and fed the latter on the leaves of the cut trees."[6]

Since those days the breeding of goats has gone on in many regions, and all sorts of changes have been produced

[4] R. Lydekker, Wild Oxen, Sheep and Goats. London, Rowland Ward, Ltd., 1898.
[5] C. Keller, Naturgeschichte der Haustiere. Berlin, Paul Parey, 1905.
[6] Keller, p. 181.



GOATS IMPROVED FOR HAIR PRODUCTION

The famous Angora breed originated in Asia Minor, but is now found in large numbers in the United States. The short coat of the Pasang has been developed to an extraordinary extent—the fleeces shown in the above photograph represent a growth of only seven months after the last shearing. Two and a half or three pounds of hair a year is an average yield for Angoras, but in some cases yields of ten or twelve pounds per animal are reached by letting the hair grow for two or three years. It is now worth about 35 cents a pound. Photograph from the U. S. Department of Agriculture. (Fig. 16.)

in its appearance; due, we must suppose, to the preservation of fortuitous variations. One of the most significant was the disappearance of the horns, a mutation of which any breeder must recognize the advantage, and which it was therefore worth while to preserve. The famous modern milk-breeds of Switzerland are hornless, but from time to time a pair of horns appears—a reversion to the ancestral habit.

Another peculiar trait which appeared at some time in domestication is the beard on the female. In most, if not all, the domesticated breeds both sexes have beards, while in the wild races this mark is confined to the males.

It has been often suggested that wild species have been crossed into the domesticated goat, and help to account for some of the diverse forms. But when the alleged cases are examined, it is usually found that the supposed wild blood is really that of tame goats who have run wild. Although it can not be denied that wild blood may have come in from time to time, it seems unlikely that any wild species except the Pasang really has an appreciable share in the ancestry of the goats known to Europe and America. This cannot be said with such confidence of the Malayan and Kashmir goats, where other wild species very likely have had a share in the production of the modern forms.

While the goat has in all times been of value as a meat producing animal, it is obvious that the effort of his breeders, during many centuries, has been in two general directions: to improve the yield of milk and to improve the yield of hair.

INCREASED MILK YIELD

Credit for the first achievement goes principally to the peasants of the Swiss valleys, who have produced a number of races that are now known all over the world. Foremost among these are the Saanen, from the Obersimmental, and the Toggenburg, from the canton of St. Gall. Starting with an animal whose milk yield was little more than that of most wild animals, they have produced does that, at their best, surpass the milk yield of a good many cows. As far as is known, this result has been achieved through simple selection of the best in each generation, as breeding stock.

Breeding for hair was accomplished principally in Asia Minor, where the town of Angora gave its name to the best known breed. The way in which the short hair of the Pasang has developed into the extraordinarily long hair of the Angora is not wholly clear, but it seems again to be due to simple selection of variations in the direction that the breeder sought.

There is nothing to indicate that the goat is particularly variable in its wild state, or that its breeders have had the advantage of any unusual variations, which do not occur in most animals. Probably easy domesticability has tended, as much as anything, to give the Pasang this important place in modern animal husbandry—an importance partly measured by the calculation that there are at least 80,000,000 goats under domestication in the world, of which only about 20,000,000 are in Europe and far less than that in the United States. It must be remembered too, that most of these are in possession of persons who have only a few animals each—it is not often that one finds a large herd of goats in the possession of one man, if we except the Angora herds in the western States of America.

In the field of live-stock breeding, there are to be found few more successful examples than that of the Pasang, bred on two different lines, and in each case with such remarkable results.

AN UNUSUAL PERSIMMON TREE

The persimmon (*Diospyros virginiana*) is known to most Americans as a small tree, often only a shrub; and most authorities on forestry state that it reaches a maximum height of 50 feet and diameter of 1 foot. Michaux remarks, "The persimmon varies surprisingly in size in different soils and climates. In the vicinity of New York it is not more than half as large as in the more Southern States, where, in favorable situations, it is sometimes 60 feet in height and 18 or 20 inches in diameter." But here is a specimen near Luxora, Ark., which is 7 feet in circumference, and is estimated to be 130 feet high. The absence of limbs on most of the trunk is probably due to the fact that the tree was crowded, and was obliged to go high in order to get sunlight. It is standing in a field of cotton and was photographed on October 6, 1914, by S. E. Simonson of Luxora. (Fig. 17.)

THE TREE THAT OWNS ITSELF

That Georgia possesses the only tree in the world that owns itself, was mentioned in the September issue of the JOURNAL OF HEREDITY by W. H. Lamb. Professor T. H. McHatton, of the State College of Agriculture, Athens, Ga., thereupon sent in the above photograph of the tree. "It is a fine, healthy white oak (*Quercus alba*)," he writes; "It is 12 feet 2 inches in circumference at 5 feet from the ground and about 60 feet high. The following is the inscription to be seen on a marble slab at the base of the tree:

" 'For and in consideration of the great love I bear this tree and the great desire I have for its protection for all time, I convey to it entire possession of itself and all land on 8 feet of the tree on all sides.—William H. Jackson.'

"Of course, in the State of Georgia a plant may not own itself; but being something out of the ordinary the will has been allowed to stand and should this tree be molested in any way there would certainly be trouble. The city takes care of it, sees that it is pruned when it needs it; has placed granite posts about its 8 feet of estate and connected them with iron chains." (Fig. 18.)

THE EFFECTS OF SELECTION

THE well known maize breeding experiments at the Illinois Agricultural Experiment Station represent, it is said, the longest continued breeding experiment now in existence, with that cereal, which ranks second only to rice in its importance as a food crop of the world. L. H. Smith describes some of the results as follows:

"Starting in 1896 with an ordinary variety of corn that contained at that time 10.9% protein, there has been produced after seventeen years a strain which now contains 14.83%, while on the other hand by selection for low protein there has been produced another strain which contained in last year's crop 7.71% protein. In other words, by the method of continuous selection of seed there have been gradually developed out of the original variety two quite different kinds of corn, one of which is practically twice as rich in protein as the other.

"Again, starting with this same variety of corn which contained originally 4.7% oil, it has been possible to produce a strain that contained in the crop of last year an oil content of 8.15%; whereas, selecting in the opposite direction has resulted in a strain that analyzed last year 1.9% oil. Or, expressed in other words, by this method of breeding, it has been possible to start with a single variety of corn, and produce two different sorts, the one of which is now more than four times as rich in oil as the other.

"In 1903, a variety of corn was taken for selection to modify the height at which the ear is borne, and selection for high ears and for low ears has continued since that time. Because of two unfavorable and rather abnormal seasons during the past two years, the results have not been so striking as those obtained in 1912, when the ears of the high-ear strain were borne at an average height of 78 inches from the ground, as compared with 25 inches in the corresponding low-ear plot. Thus there was an average difference amounting to over 4½ feet, a most graphic demonstration of the power of selection in corn to influence certain characteristics with respect to habit of growth.

"Another line of selection affecting habit of growth was begun in 1904 in which the endeavor has been to modify the angle at which the ear hangs on the stalk. In one strain the selection has always been for ears standing erect while in a corresponding strain the seed has been chosen from ears that hang downward. The comparison is made each year by measuring the angle at which the ear declines from the perpendicular. Last season's results gave an average of 66 degrees for the erect ears as compared with 124 degrees for the declining. This particular habit is one that is easily affected by environmental disturbances and this last year's results are not so striking as that obtained two years ago when the average difference in angle between the two strains amounted to 73 degrees.

"Still another line belonging to this same general category of selection to modify physical characteristics of the corn plant is that which was started ten years ago to develop from an ordinary single-eared variety a strain which should bear two ears to the stalk. In the season the first selection was made, the proportion of two-eared stalks was only 2½%. This proportion has been very materially increased, varying greatly in different years with the environmental influences, but on the whole showing a marked response to the selection so that last season the proportion of two-eared stalks was the highest that has yet been attained, namely 73%.

"In addition to the experiments above described to modify through the method of continuous selection these physical and chemical characteristics of corn, there is being conducted a comprehensive fundamental study of heredity in maize with reference to the unit characters and their modes of transmission. This investigation is being conducted mainly by the method

of hybridizing varieties of diverse characters and observing the resulting Mendelian phenomena. Hundreds of separate independently transmissible characters are being observed and the study of them is leading to a knowledge of some highly important principles. For example several detrimental characters such as partial or complete lack of chlorophyl, barrenness, sterility, and others which may have a more or less direct practical bearing upon yield, are included in this study of unit characters.

"This same kind of analytical study is being extended to several of our other field crops such as wheat, oats, clover, alfalfa, soy beans, millet, broomcorn, sorghum, and sweet clover."

A number of promising strains of wheat and oats have been isolated at the same station, and it is hoped that they will soon be ready to appear in the trade. It is calculated that eight years, on the average, are required to multiply and test a new strain of cereal sufficiently to establish it, if it is worthy.

The soy bean, a legume that is gradually coming into favor in Illinois because of its use in crop rotation, is getting a good deal of attention, and appears to be particularly responsive to selection, which is directed in two different lines: to make beans valuable for oil production, and to improve them for human food.

Some Apple Statistics

Variation in apples has been investigated at the Massachusetts agricultural experiment station, the entire crops borne by certain Baldwin and Ben Davis trees being measured for six successive years. As expected, a great difference was found in the productivity of different trees, and a slight difference in the amount of variability. It is possible that the larger the apples a tree bears, the more variable they are. The apples from the upper south parts of the trees, which were largest, were also the most flattened, and there is found to be a pretty constant relationship between the form of the apple and the temperature for a period of several weeks following the bloom; the cooler this period, the more elongated the apple. The station now has Mendelian experiments under way with peas, beans and squashes, and has made much progress in breeding rust-proof asparagus, in coöperation with the federal department of agriculture. The garden pea study has shown that the ordinary commercial varieties are composed of many different strains or pure lines; work is now being carried on to determine whether selection within the pure line can increase or decrease vine length, and to determine the degree of correlation between weight of seed and length of vine. The study of the squash has also shown the common varieties to be of heterogeneous composition and the particular point now under investigation is to determine whether homozygous races may be isolated. The study of the inheritance of pigmentation and other characters in garden beans during the last six years has embraced more than 100 crosses of sixteen varieties, and included more than 50,000 plants, all of which have been carefully studied and tabulated.

Inheritance of Bad Temper

In Bulletin No. 12, I, of the Eugenics Record Office (Cold Spring Harbor, L. I., September, 1915), Dr. C. B. Davenport presents a study of the family history of 165 wayward girls, with a view to determining the heritability of violent temper. He concludes that "The tendency to outbursts of temper—'tantrums' in adults—whether more or less periodic or irregular and whether associated with epilepsy, hysteria or mania, or not, is inherited as a positive (dominant) trait, typically does not skip a generation and tends, ordinarily, to reappear, on the average, in half of the children of an affected parent."